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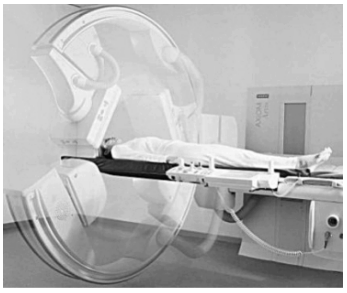

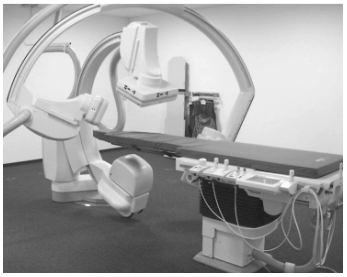

Operator Manual Volume 2

AXIOM Artis

Systems for Angiocardiography, Angiography, Neuroradiology, Interventional Procedures and General Diagnostics

Artis VB30B and higher
(*syngo* ® VD30C and higher)

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Siemens AG
Wittelsbacher Platz 2
DE-80333 Muenchen
Germany

Contact Information:
Siemens AG, Medical Solutions, AX
Siemensstrasse 1
DE-91301 Forchheim
Germany
Phone: +49 9191 18-0
Internet: www.Medical.Siemens.com

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Important information from the manufacturer

CE
0123

This product is provided with a CE marking in accordance with the regulations stated in Appendix II of the Directive 93/42/EEC of June 14th, 1993 concerning medical devices.

In accordance with Appendix IX of the Directive 93/42/EEC, this device is assigned to class II b.

The CE marking applies only to medical devices which have been put on the market according to the above-mentioned EC Directive.

Unauthorized changes to this product invalidate this declaration.

Please observe the **Operator Manual Volume 1**.
Important information is given there.

The original version of this manual was written in English.

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Operator Manual
Abbreviations/Glossary

in alphabetical order

AXIOM Artis Product name of the modular angiography system from Siemens

Artis •F- **F**loor-mounted C-arm

Artis •B- **B**iplane system

Artis •T- **T**op-mounted C-arm

Artis •-A **A**ngiography system

Artis •-C **C**ardiography system

Artis •MP **M**ulti**P**urpose system

Artis d-- System with flat **d**etector

Examples:
- ❏ Systems for angiocardiography (AXIOM Artis (d)FC/(d)BC/(d)TC)
- ❏ Systems for universal angiography (AXIOM Artis (d)FA/(d)TA)
- ❏ Systems for neuroradiology (AXIOM Artis (d)BA)
- ❏ Multipurpose systems (AXIOM Artis dMP)

Angio Angiography, examinations of vessels

Angio collimator X-ray collimator mainly used in angiographic systems equipped with rectangular and iris diaphragms and also with one finger and two wedge semitransparent filters

BSA Body Surface Area

CARD Cardiography, examinations of the heart

Card collimator X-ray collimator mainly used in cardiographic systems equipped only with rectangular diaphragms and one semitransparent finger filter

Card (Sub)task card. Elements of the *syngo* ® user interface are arranged in stacks of cards.

CAUD Caudal direction of motion of the → **I.I./FD** (footwards)

CCM Collimator Control Module, console for setting the primary collimator

CF	Calibration factor
CM	Contrast medium
CRAN	Cranial direction of motion of the → **I.I./FD** (headwards)
DA	Digital angiography, digital acquisition technique without subtraction
DCS	Display Ceiling Suspension, support system for → **LCD** monitors
DMG	Dead Man's Grip: Unit movements are controlled by a dead man's grip, that is, movements are performed only while the operating element is being actuated.
DR	Digital radiography, digital acquisition technique without subtraction
DSA	Digital Subtraction Angiography, digital acquisition technique with subtraction
ED	End diastole, heart phase
EDV	End-diastolic volume, volume of the ventricle in the → **ED**
EF	Ejection Fraction, measure of cardiac performance
ES	End systole, heart phase
ESV	End-systolic volume, volume of the ventricle in the → **ES**
f/s	frames per second, frame rate during acquisition
fps	frames per second
FD	Flat detector
FL	Fluoroscopy
Frame[1]	Single frame of a multiframe image (scene)
HIS	Hospital Information System
HU	Heat Unit, thermal load state of the tube assembly, stated as a percentage
I.I.	Image intensifier
IS	Imaging system
IS joystick	Joystick on the touchscreen control, operating element which functions similar to a mouse, used for operating the imaging system
kV	Kilovolt (1 kV = 1,000 V), unit for measuring tube voltage

[1] one of a series of images to form a movie-like sequence

LA(P)O	Left Anterior (Posterior) Oblique, angle of rotation of the image plane in degrees, to the left of the reference vertical
LCD	Liquid Crystal Display, monitor with flat screen
LED	Light-Emitting Diode, indicator lamp of a control element
LIH	**L**ast **I**mage **H**old, display of the last fluoroscopic or acquisition image
LVA	Left Ventricle Analysis, calculation of the ejection fraction and wall motion of the *left* ventricle of the heart
mA	Milliampere (1 mA = 1/1,000 A), unit for measuring tube current
mAs	Milliampere seconds, unit for the product of tube current (mA) and time (s). Equivalent to the applied radiation dose
µGy	Microgray (1 µGy = 1/1,000,000 Gy), unit for measuring radiation dose
MSS	Monitor Suspension System
Multiframe image	A multiframe image is an image object (scene) whose pixel data consist of a sequence of single frames.
OM	Operator Manual
OR	Operating Room
OT	Overtable: → **I.I./FD** is above the table
P/s	Pulses per second, frame rate for fluoroscopy
QVA	Quantitative Vascular Analysis, calculation for dimensions of vessel sections
QCA	Quantitative Coronary Analysis, calculation for dimensions of coronary arteries
RA(P)O	Right Anterior (Posterior) Oblique, angle of rotation of the image plane in degrees, to the right of the reference vertical
RESET	Reset
RIS	Radiology Information System
ROI	Region of Interest, region under examination
SC	Service Center. This abbreviation in messages means: "Call Service"
SCM	Stand Control Module, console for operating a Stand/C-arm
SD	Standard deviation, a parameter in statistics

SID Source-to-Image Distance, or distance between the source and the → **I.I./FD** in cm

TCM Table Control Module, console for operation of the patient table

TOD Table-to-Object Distance, distance between the tabletop and the center of the organ, used for calibration

UT Undertable: → **I.I./FD** is below the table

WW Window Width (contrast)

WC Window Center (brightness)

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System Overview / Operating Elements

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Introduction

Application

AXIOM Artis is a fully digital angiography system equipped with image intensifier or flat detector technology.

Applications

Depending on the system configuration, an AXIOM Artis is suitable for innovative cardio-vascular examinations and interventions, universal angiography procedures and interventional procedures.

The multi-purpose X-ray system Artis dMP is suitable for angiography and interventions as well as general X-ray diagnostics.

Operating locations

An AXIOM Artis is suitable for the following applications and operating locations:

- ❏ Fluoroscopy with radiography (acquisition) -
  Operator close to the patient (application category A)
- ❏ Fluoroscopy with radiography (acquisition) -
  Control of X-radiation during radiography from a protected area
  (application category B)

System configurations

- ❏ Artis dFC/dFA: Systems with one floor stand / one acquisition plane
- ❏ Artis dBC/dBA: Systems with a floor stand and a top stand / two acquisition planes (biplane)
- ❏ Artis dTC/dTA: Systems with one top stand / one acquisition plane
- ❏ Artis dMP is available in two versions:
  – Right mounting: tabletop attached on the right
  – Left mounting: tabletop attached on the left

The system can be equipped with different options supporting the different clinical applications

Flat Detector (FD)

Image acquisition is performed through a flat detector followed by digital image processing and documentation.

- ❏ FD 20x20 with 20 cm x 20 cm input field (25 cm Ø)
- ❏ FD 30x38 with 30 cm x 38 cm input field (48 cm Ø)

Please note the following differences of systems equipped with flat detector(s) as compared with a system equipped with image intensifier(s):

- ❏ The irradiated acquisition/fluoroscopy field is square (FD 20x20) or rectangular (FD 30x38).
- ❏ The data display shows the (approximate) diagonals of the corresponding squares or rectangulars.
- ❏ We recommend performing fluoroscopy briefly before each acquisition series. This is especially important for children and thin patients.

Imaging system

The Artis Imaging System is suitable for digital image acquisition and reporting with the AXIOM Artis radiographic systems.

It can be used both in *single plane* and in *biplane* systems.

The imaging system can be *modularly* equipped for different applications according to its use.

Acquisition modes

The following digital acquisition modes and associated postprocessing functions are possible:

- ❏ Digital radiography (DR)
- ❏ Angiocardiography (CARD)
- ❏ Digital subtraction angiography (DSA)

Both acquisition series (scenes) and single images are possible.

Special acquisition modes

Angiography with stepping (peripheral angiography):

- ❏ PERISTEPPING
- ❏ PERIVISION

Rotational angiography:

- ❏ DR-DYNAVISION
- ❏ (DSA-)DYNAVISION

Artis dMP scanning examination:

- ❏ DR-Scanning

Equipment in the Control Room

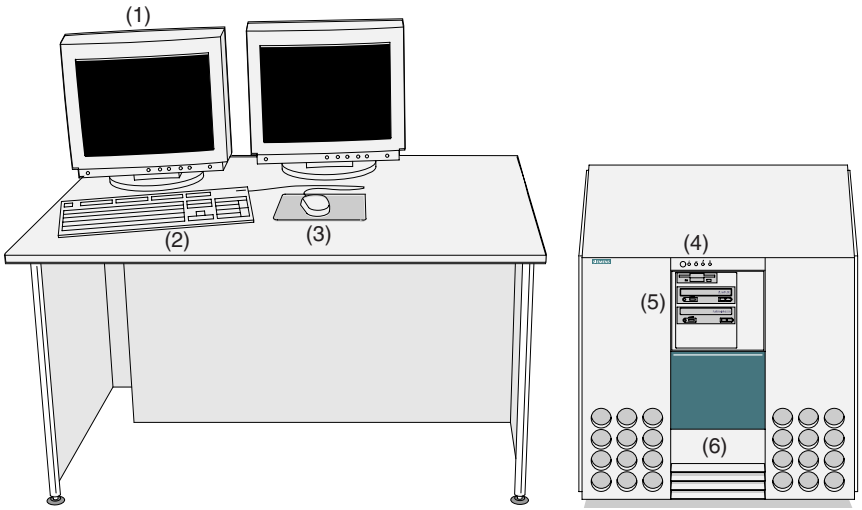
Imaging system overview

The imaging system comprises the computer with electronics for image acquisition and image processing, input devices and monitor(s).

System console

The system console is used for patient administration, postprocessing and archiving. Using a footswitch or handswitch you can also release acquisitions here.

In addition, the system console is used to switch the system on and off.



Example: System console in the control room (with two monitors)

(1) Monitor(s) (LCD or SIMOMED)

(2) Keyboard

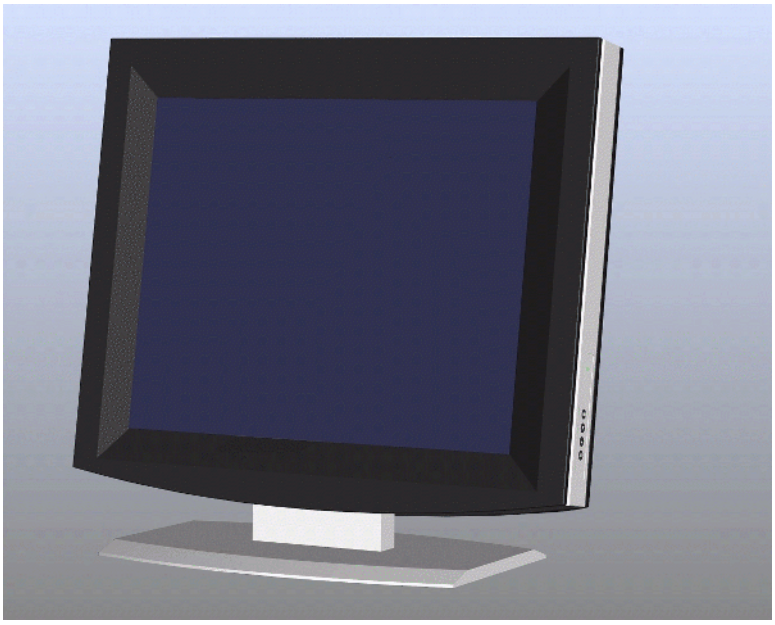
(3) Mouse

(4) Power-on switch and indicators

(5) Drives

(6) Computer with electronics

LCD monitor(s)



Operating elements

The keys for setting the LCD monitor are located on the side or on the bottom of the housing.

The necessary settings are made at installation. No operator actions are required during operation.

Power on/off

The unit has a power switch on the underside. You only need to operate this switch if the LCD monitor is not switched via a system.

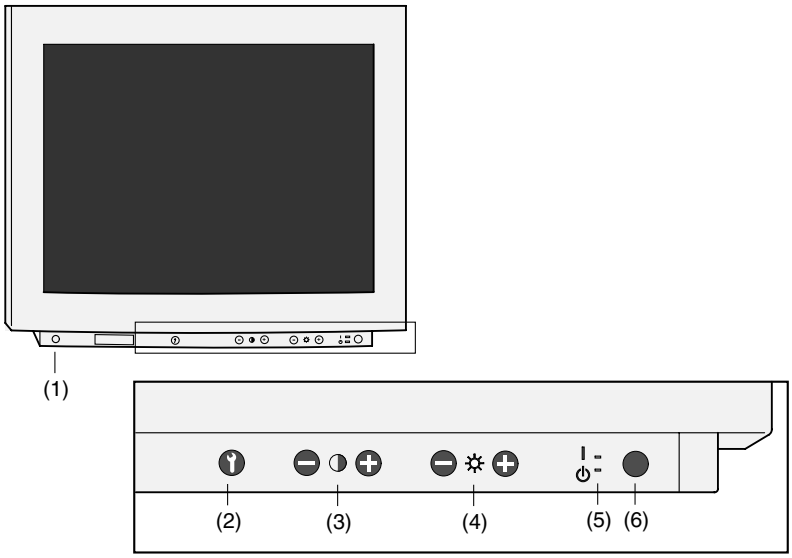
Operating indicator

The unit has a green LED operating indicator on the right above the operating elements (which are not operated).

Errors

- ❏ If the LCD monitor shows no image, a blurred image, vertical lines or other unwanted phenomena, please contact Siemens Service.
- ❏ If no input signal is applied.

SIMOMED monitor(s)



(1) Room light sensor[1]

(2) Monitor settings (for Service only)

(3) Contrast setting

(4) Brightness setting

(5) LED operating indicators

(6) Power on/off switch

Switching on and off

The SIMOMED monitors are automatically switched on/off with the system. The green LED operating indicator (5) must light up.

Room light sensor[1]

The SIMOMED HM monitors are equipped with a room light sensor (1): The brighter the ambient light, the greater the contrast adjusted on the monitor, up to a certain maximum value (can be switched on or off by Siemens Service).

Brightness and contrast

The brightness (4) and contrast (3) are factory set for optimum image quality and can only be changed by a service engineer.

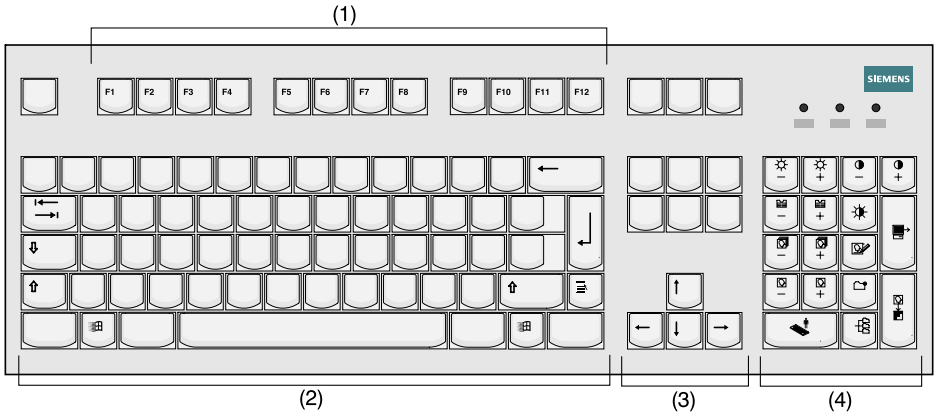
⇨ For color monitors, please observe the **manufacturer's documentation**.

⇨ Please observe the notes in Register **Safety (Volume 1)**.

[1] SIMOMED HM only

Keyboard

The imaging system is equipped with a PC keyboard with a symbol keypad.



PC keyboard (different for different languages)

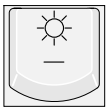
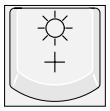
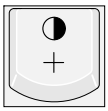
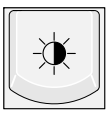
(1) Function keys

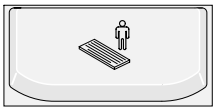
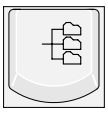
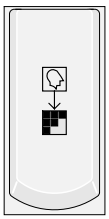
(2) Alphanumeric keys (vary for different languages)

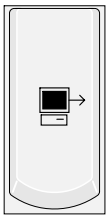
(3) Cursor control keys

(4) Symbol keypad

Keys on the symbol keypad

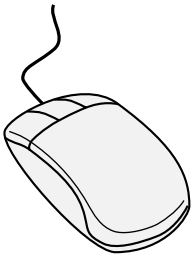
Key	Function
	Window center (WC) - (**Num⇓**) (Brightness -)
	Window center (WC) + (**Num /**) (Brightness +)
	Window Width (WW) - (**Num ***) (Contrast -)
	Window Width (WW) + (**Num -**) (Contrast +)
	Autowindowing (**Num 9**)

Key	Function
	Scroll study back (**Num 7**)
	Scroll study forward (**Num 8**)
	Scroll series/scene back (**Num 4**)
	Scroll series/scene forward (**Num 5**)
	Scroll image back (**Num 1**)
	Scroll image forward (**Num 2**)
	Mark image (**Num 3**)
	Modify scene name (**Num 6**) (in preparation)
	Call up **Patient Registration** (**Num 0**)
	Call up **Patient Browser** (**Num ,**)
	**Copy to Film Sheet** (**Num Enter**)

Key	Function
	**Send To** preferred network node (**Num +**)

Mouse

A mouse with *three* buttons is connected to the computer.



Example

3 buttons You can start actions of the program with the mouse buttons:

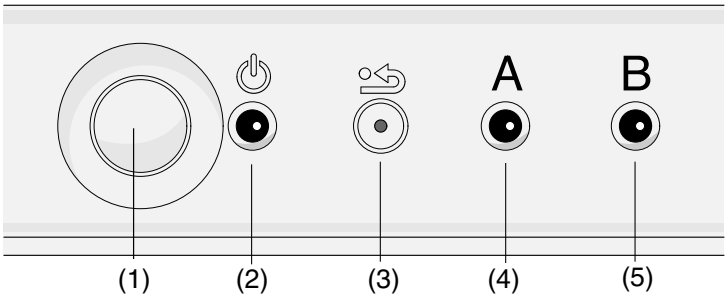
- ❏ With the left button, for example, you can select objects, start applications and execute commands.
- ❏ With the center button you can change the window values of images.
- ❏ With the right button you can open popup menus.

Click In this Operator Manual, various terms are used in connection with the mouse:

- ❏ **Click**: Move the mouse such that the mouse pointer on the screen points to the object in question. Now press the mouse button[1] and release it again.
- ❏ **Double-click**: Like clicking, except that you press the mouse button twice in quick succession.
- ❏ **Drag & drop**: Like clicking, except that you keep the mouse button pressed while moving the mouse.

[1] Where "click" appears in the text, we always refer to the left mouse button unless the right mouse button is mentioned explicitly.

Power-on switch and indicators



(1) Power-on switch

(2) Standby indicator

(3) RESET button

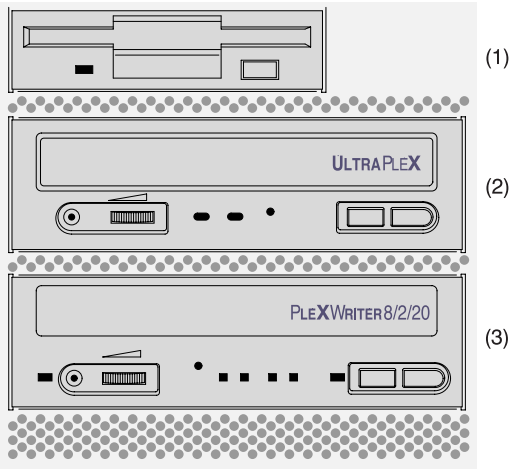
(4) Indicator for access to system disk 1

(5) Indicator for access to system disk 2

The two indicators for access to system disks (4) and (5) indicate that the imaging system is still "working".

Drives

The housing of the Artis Imaging System contains various drives.



Example

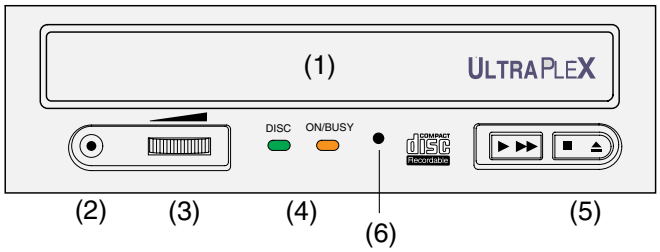
(1) Diskette drive for service purposes

(2) CD drive for reading data and programs

(3) CD-R drive ("CD recorder") for archiving

CD drive

The drive has an ejection button and an LED that indicates the status of the drive.



CD drive (example)

(1) Tray on which the CD is inserted

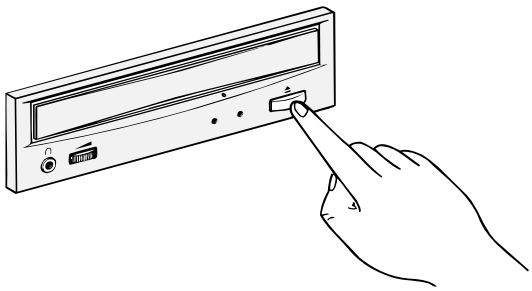
(2) Headphone connection (not used).

(3) Volume control (not used).

(4) Status display LEDs

❏ CD drive
  – LED lit during a read operation.

❏ CD writer
  – ON/DISC (orange) lit when no CD is inserted.
  – ON/DISC (green) lit when the CD can be read, flashes while searching.
  – READ/WRITE (green) lit during a read operation.
  – READ/WRITE (orange) lit during a write operation.



(5) Ejection button for removing the CD.

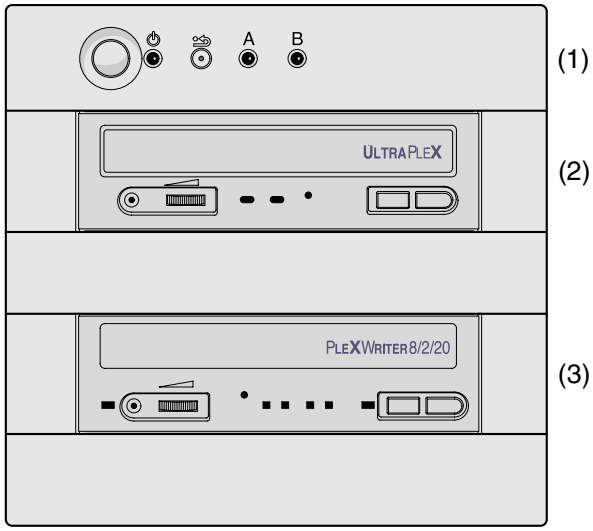
During a read or write operation, this function is disabled by the software. During this time the button has no function.

(6) Emergency ejection for removing a CD in an emergency (drive fault).

ON box with CD drive(s)

The imaging system can be set up in a separate room.

The switches and indicators of the imaging system and the CD drive and, if applicable, the CD writer are then mounted in a separate housing that is located in the control room instead of the imaging system.



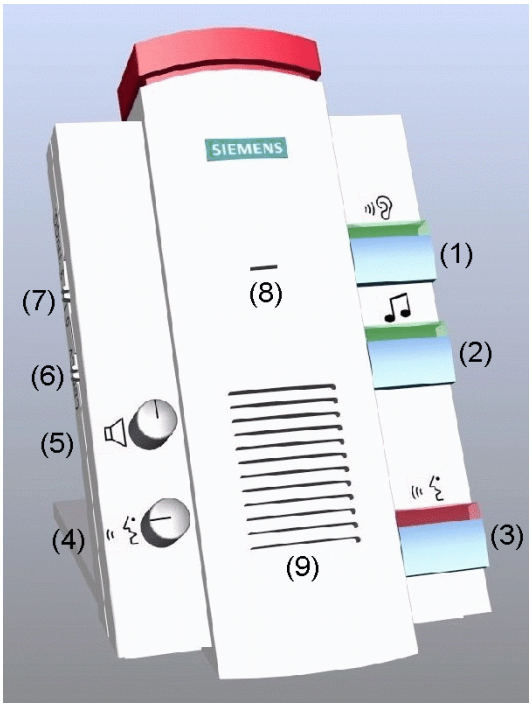
Example

(1) Power-on switch and indicators

(2) CD drive

(3) CD writer

Intercom system



(1) Listening on/off with LED display (green)

(2) Music on/off with LED display (green)

(3) Speech on/off with LED display (green)

(4) Speaking volume (in the examination room)

(5) Listening volume (in the control room)

(6) Without function

(7) Without function

(8) Microphone

(9) Loudspeaker

If speech is switched on, listening is not possible and music is interrupted.

On-site equipment

The following switches and keys are installed on site. Their location depends on the circumstances and location of your system.

◆ Find out where these switches and buttons are located.

Disconnection from the power supply

The main switch disconnects the entire system from the power supply (power supply interruption).

⇨ Part **Safety (Volume 1)**

Emergency SHUT-DOWN button

With the emergency SHUTDOWN button the system can be disconnected from the power supply in an emergency.

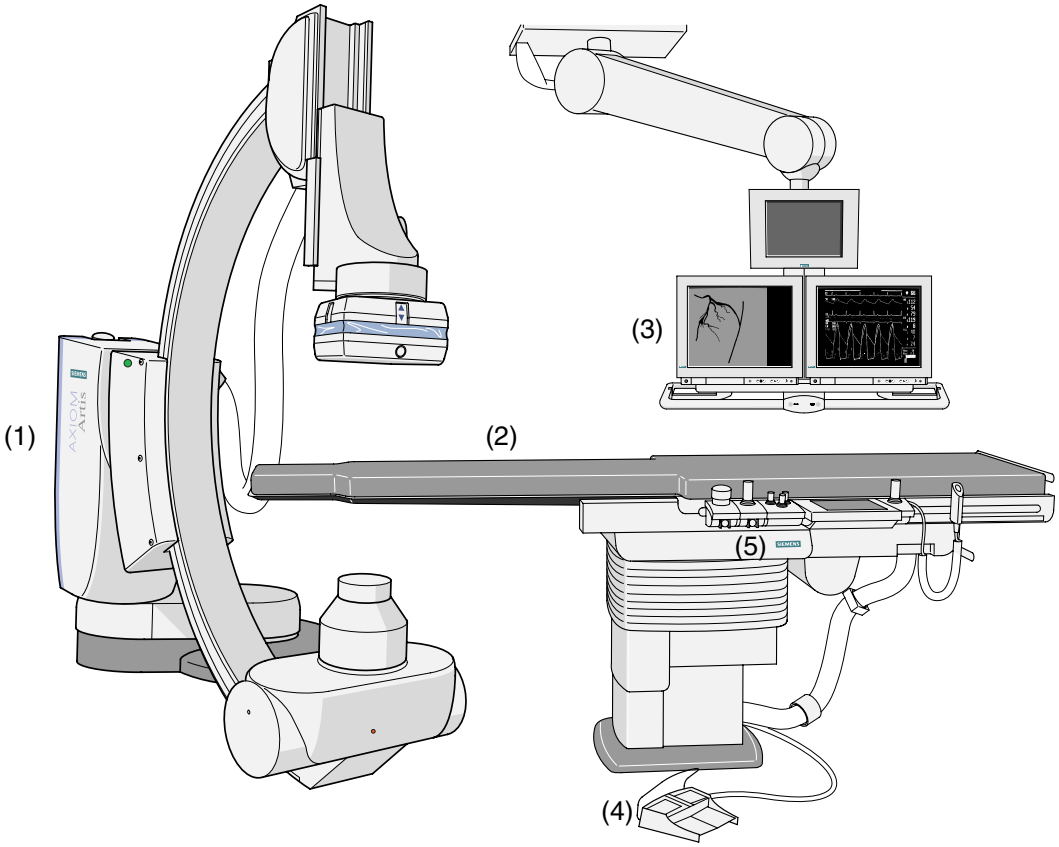
⇨ Part **Safety (Volume 1)**

Door contacts

The doors to the examination room can be fitted with switching contacts which prevent radiation from being released while a door is open.

Acquisition system overview

Overview Artis dFC/dFA



Example: Artis dFC with FD 20x20 and 2 monitors

(1) Floor stand with C-arm, X-ray tube assembly and FD

(2) Patient table

(3) Monitor suspension system with monitors and data display

(4) Footswitch for releasing radiation

(5) Control console for controlling the stand, patient table and imaging system

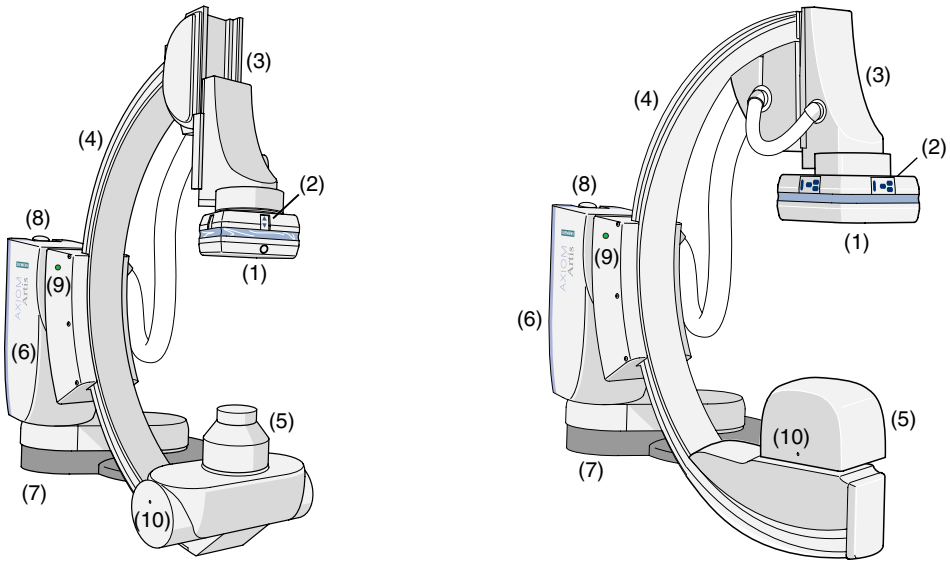
The floor stand (Artis dFC/dFA and Artis dBC/dBA)

Each Artis dFC/dFA or Artis dBC/dBA system is equipped with a floor stand. This is mounted on a swivel base. The stand can be moved between working and parking positions on the swivel base.

With Multispace F, you can rotate the floor stand completely.

The stand can be moved into various positions relative to the patient. Oblique projections are possible by rotational and orbital movement (angulations) of the C-arm.

The X-ray tube assembly with primary collimator and the flat detector (FD) are attached to the C-arm. The FD is mounted on a lifting device for a variable SID.



Floor stand with FD 20x20 (left) and FD 30x38 (right)

(1) Flat detector (FD)

(2) Membrane keys

(3) FD slide

(4) C-arm

(5) X-ray tube assembly with primary collimator

(6) Stand column

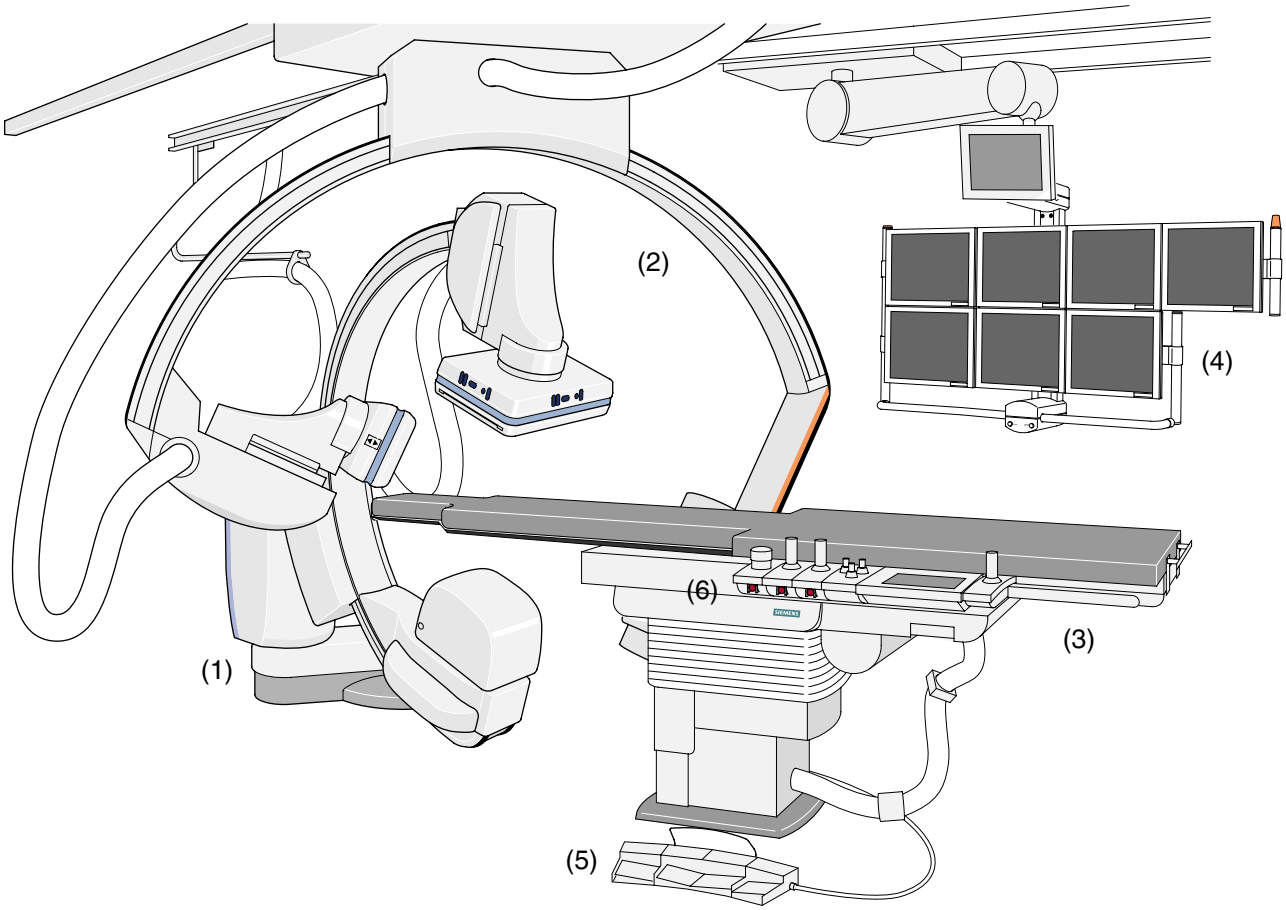
(7) Swivel base

(8) Unlocking button (Multispace F only)

(9) "Plane ready" display (green)

(10) Focus point (red)

Overview Artis dBC/dBA



Example: Artis dBA with FD and 6+1 monitors

(1) Floor stand with C-arm, X-ray tube assembly and FD

(2) Top stand with C-arm, X-ray tube assembly and FD

(3) Patient table

(4) Monitor suspension system with monitors and data display

(5) Footswitch for releasing radiation

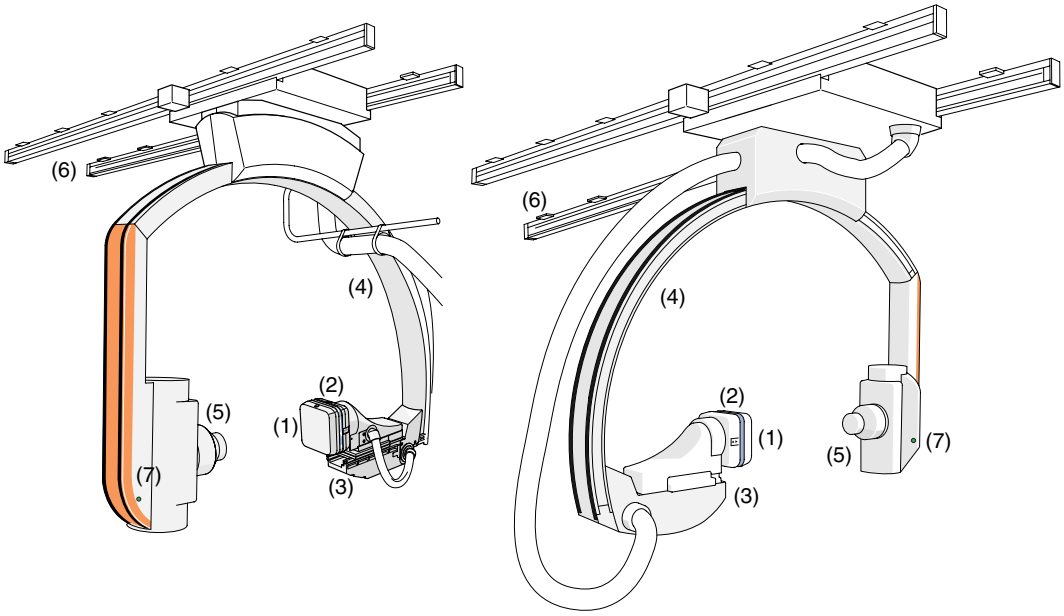
(6) Control console for controlling the stand, patient table and imaging system

The top stand (Artis dBC/dBA)

In addition to the floor stand, Artis dBC/dBA systems are also equipped with a top stand mounted on a ceiling rail (plane B).

The top stand has two working positions as well as one parking position at the head end behind the floor stand. Oblique projections are possible by rotational and orbital movement (angulations) of the C-arm.

The X-ray tube assembly with primary collimator and the flat detector (FD) are attached to the C-arm. The FD is mounted on a lifting device for a variable SID.



Artis dBC top stand (left) and Artis dBA top stand (right)

(1) Flat detector (FD)

(2) Membrane keys

(3) FD slide

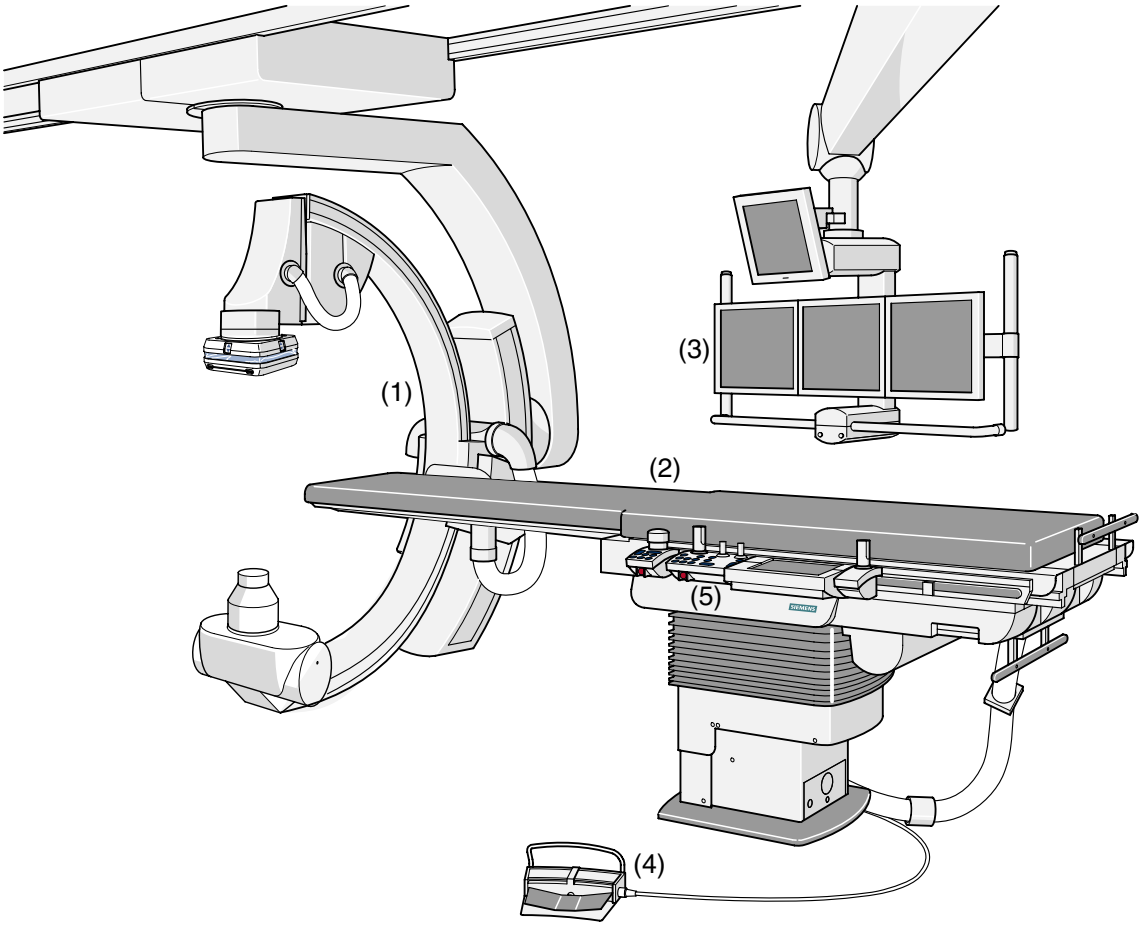
(4) C-arm

(5) X-ray tube assembly with primary collimator

(6) Ceiling rails

(7) "Plane ready" display

Overview Artis dTC/dTA



Example: Artis dTC with FD 20x20

(1) Stand with C-arm, X-ray tube assembly and FD

(2) Patient table

(3) Monitor suspension system with monitors/LC displays and data display

(4) Footswitch for releasing radiation (programmable)

(5) Control consoles for controlling the stand, patient table and imaging system

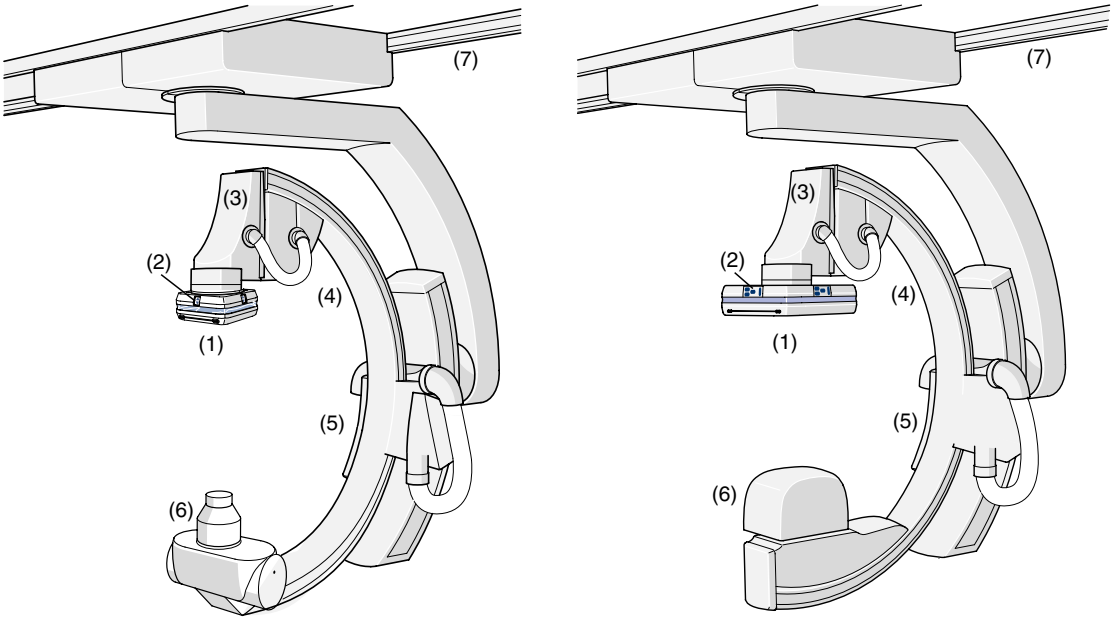
Artis dTC/dTA Stand/C-arm

An Artis dTC/dTA system is equipped with a ceiling-mounted stand with a C-arm.

The stand (with C-arm) is mounted on rails and can be positioned longitudinally by motor drive. The C-arm can be swiveled about its longitudinal axis by motor drive. The stand swivel and projection angles can be set isocentrically.

Angulation movements are performed either by moving the inner C-arm, the orbital lift carriage on the outer C-arm, or by combined movements.

The X-ray tube assembly with primary collimator and the flat detector (FD) are attached to the C-arm. The FD is mounted on a lifting device for a variable SID.



Artis dTC stand with FD 20x20 (left) and Artis dTA stand with FD 30x38 (right)

(1) Flat detector (FD)

(2) Membrane keys

(3) FD slide

(4) C-arm

(5) Telescopic C-arm slide

(6) X-ray tube assembly with primary collimator

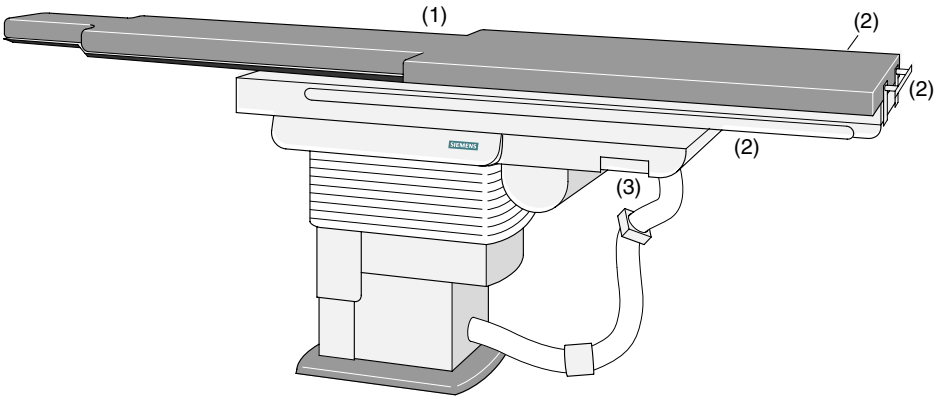
(7) Ceiling rails

Floor-mounted patient table

AXIOM Artis systems equipped with a separate patient table have a floor-mounted table with a floating carbon-fiber tabletop with projecting and shadow-free sections optimized for tall patients.

The table height and tabletop longitudinal and transverse positions are continuously adjustable. The patient table can also be swiveled.

The table can be equipped with a motor-driven stepping mechanism for peripheral examination techniques. A tilting tabletop is also possible (transverse or transverse and longitudinally) with the OR version.



(1) Tabletop with mattress

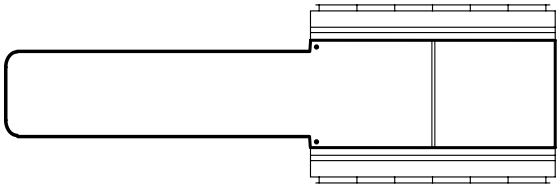
(2) Slidable rails for control modules and other accessories

(3) Lever for releasing the table swivel lock

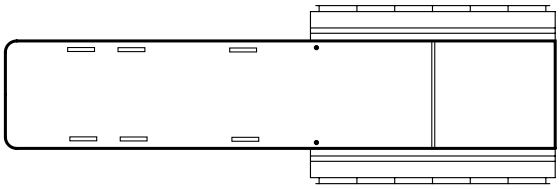
Tabletops

The tabletop can be removed and exchanged[1].

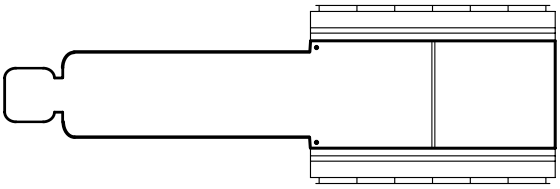
The following versions are available[1]:



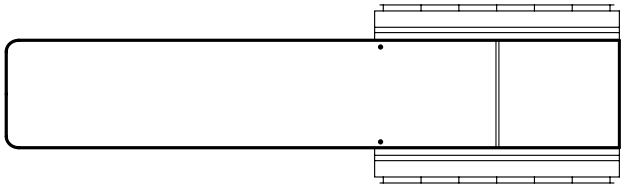
Tabletop narrow



Tabletop wide



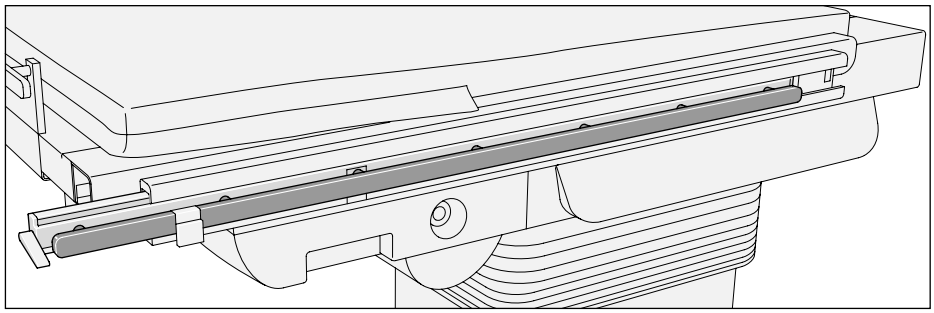
Neuro tabletop



OR tabletop

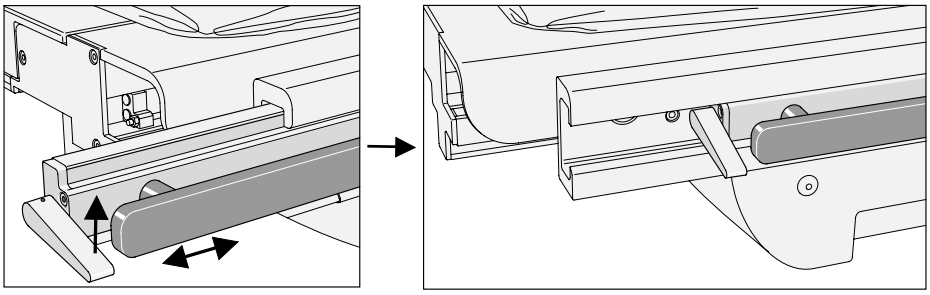
[1] not with the Multispace F

Accessory rails



Rails for control modules and other accessories are attached to the table.

The two lateral accessory rails can be moved headward or footward to facilitate operation during head-end interventions or patient transfer.



An accessory rail can be moved by lifting the rail lever at the foot end.

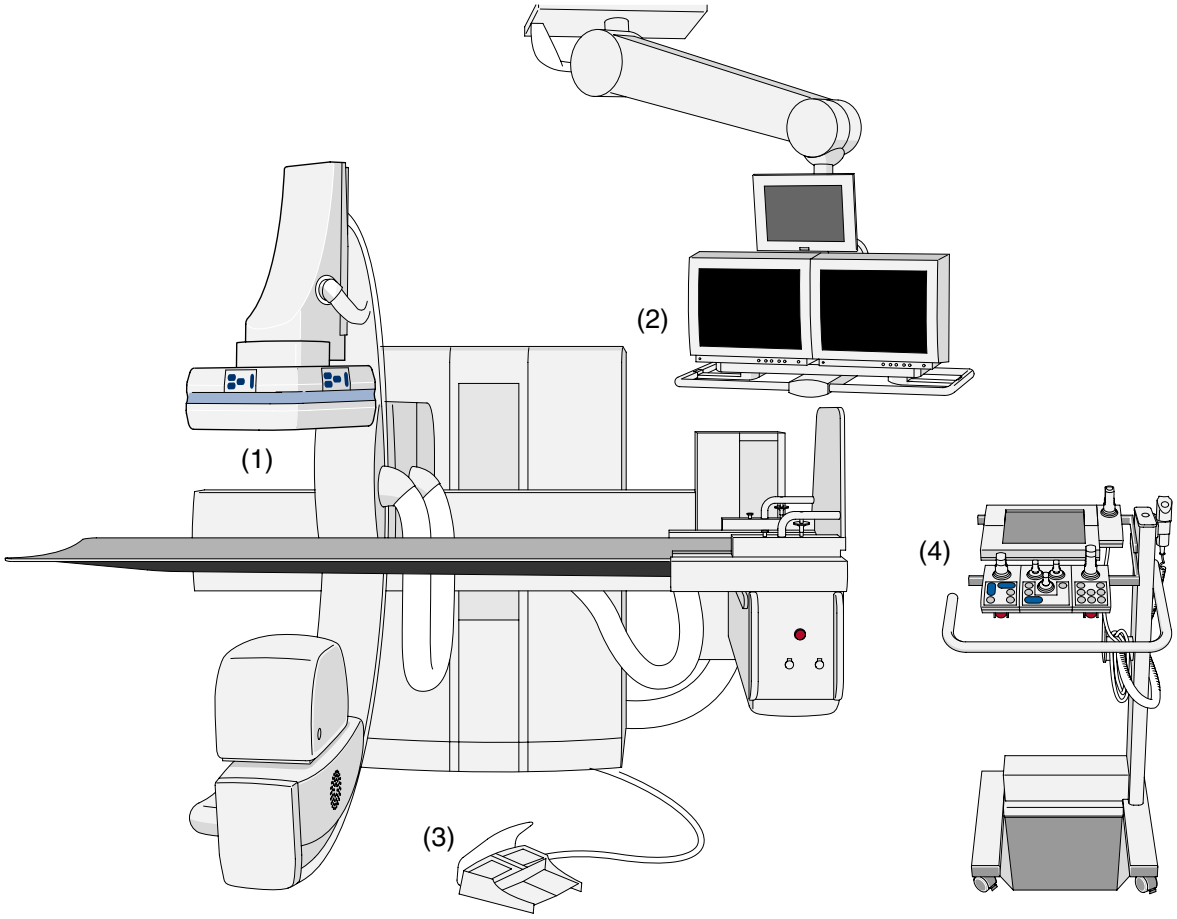
- ❏ Headward movement through several latch positions is possible.
- ❏ Footward movement (patient repositioning) is not latched.
- ❏ On tilt tables, footward movement is limited to 200 mm for collision avoidance reasons.

Connectors

The following connectors may be provided at the foot end of the patient table:

- ❏ on the table base at the bottom left and/or right:
  for compressed air and ultrasound
- ❏ on the top part of the table on the left and/or right:
  for injector and ECG (The injector can also be connected to a wall-mounted injector connection box.)
- ❏ Country-specific power outlet (see **Planning Guide**)

Overview Artis dMP



Artis dMP with right mounting

(1) Stand with C-arm, X-ray tube assembly, FD and patient table

(2) Monitor suspension system with monitors and data display

(3) Footswitch

(4) Trolley for control modules with control modules

Artis dMP is available in two versions:

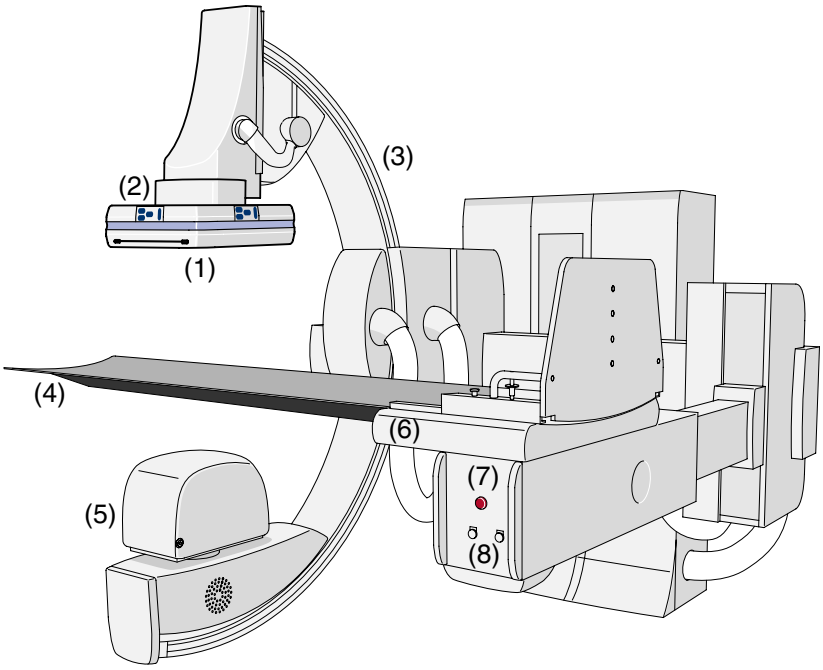
- ❏ Right mounting: tabletop attached on the right
- ❏ Left mounting: tabletop attached on the left

Artis dMP Stand/C-arm

An Artis dMP system is equipped with a C-arm stand with an integrated patient table.

The acquisition system and the patient table can be moved relative to each other in all directions. The system also allows oblique projections by rotational and orbital movement (angulations) of the C-arm.

The X-ray tube assembly with primary collimator and the flat detector (FD) are attached to the C-arm. The FD is mounted on a lifting device for a variable SID.



Artis dMP system

(1) Flat detector (FD)

(2) Membrane keys

(3) C-arm

(4) Patient table

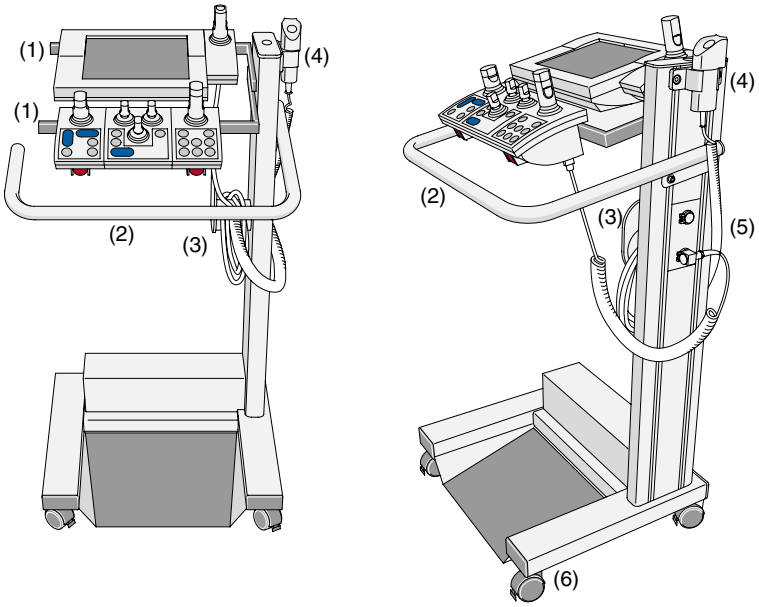
(5) X-ray tube assembly with primary collimator

(6) Rails for the footboard and other accessories

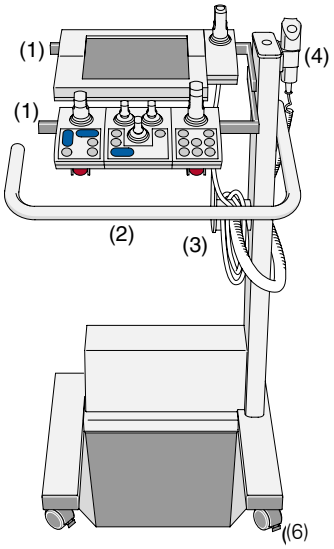
(7) Emergency STOP button

(8) Connectors for control modules

Trolley for control modules



Artis dMP trolley (standard)



Trolley for other systems

(1) Rails for control modules and other accessories

(2) Grip

(3) Cable holder

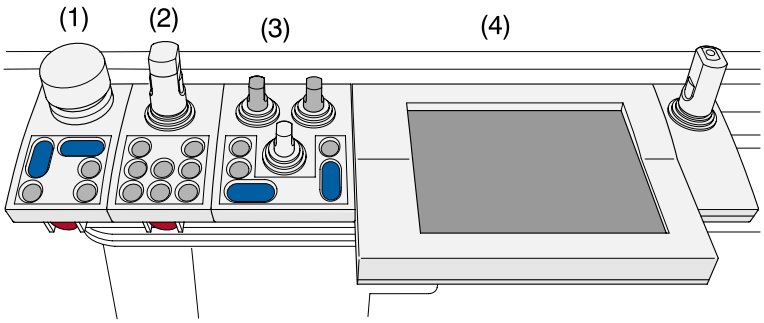
(4) Holder for handswitch

(5) Connectors for control modules

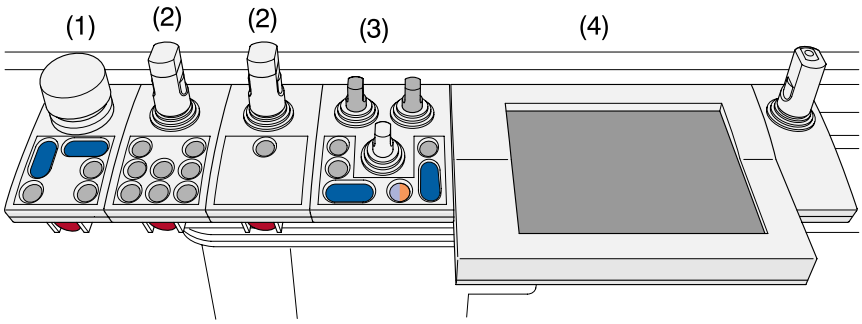
(6) Castors (without brakes)

Operating Elements and Displays in the Examination Room

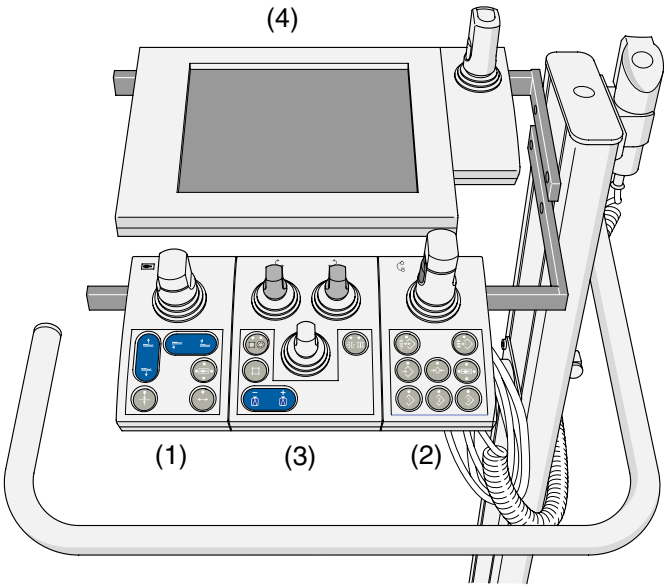
Control consoles



Control console single plane (example)



Control console biplane (example)



Control console Artis dMP (example)

Depending on the type and configuration, your system consists of one grouped or several individual control modules.

There are four basic types of control modules:

(1) Table (Table Control Module TCM)

(2) Stand/C-arm (Stand Control Module SCM)

(3) Collimation and filter (Collimator Control Module CCM)

(4) Imaging system (Touchscreen Control)

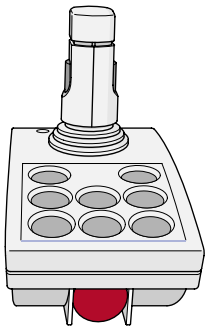
The control modules are equipped with a joystick and several keys.

Blue keys release an action immediately, e.g. movements.

Gray keys are used to preselect an action.

Emergency STOP button

There is an emergency STOP button on the front side of every table or stand/C-arm control module.



Example

This button can be pressed to stop unit movements and radiation[1] in an emergency.

⇨ Part **Safety (Volume 1)**

[1] Radiation can be released again after a short interruption.

Table control module (TCM)

Table control modules are marked by a patient table symbol.

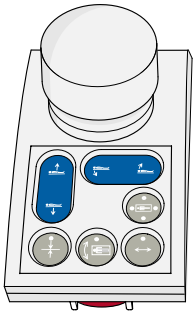
Table joystick/panning knob

With the table joystick/panning knob you can adjust the tabletop position by pressing down the joystick and tilting it to one side.

Systems with separate patient table

Depending on your patient table version, one of two versions will be integrated in the table:

❏ TCM-M/S: Knob with floating tabletop
(with or without servo assistance)



❏ TCM-J: Joystick on additional control console

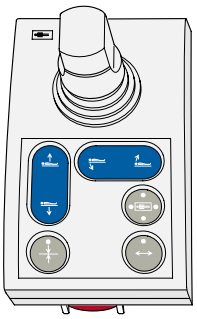
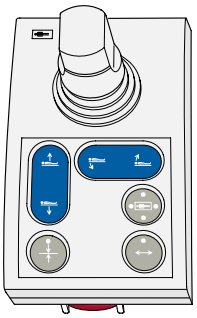


Table control module	Joystick/panning knob	Used with
TCM-M	manual	table without tilt
TCM-S	servo-assisted	table with tilt
TCM-J	with joystick	additional control console

Artis dMP

❏ Joystick (standard)



❏ Knob on control module for "floating tabletop" (with servo assistance)

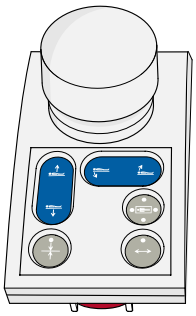
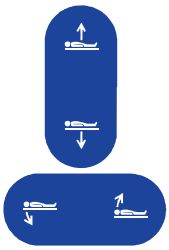


Table control module	Joystick/panning knob	Used with
TCM-J	with joystick, motorized	standard console on the Artis dMP trolley
TCM-S	with knob, servo-assisted	console on the table

Keys on the table control module

The following other movements can be controlled with the keys on the table control module:



❏ Table lift (blue = immediate movement)
– light pressure: low speed
– strong pressure: high speed

❏ Table tilt (blue = immediate movement)
– light pressure: low speed
– strong pressure: high speed

❏ Lateral table tilt (gray = select/deselect function)

❏ Unlock brakes for table swivel

❏ Isocenter (gray = select/deselect function)

⇨ “Isocenter key” on page 61

❏ Lock for lateral tabletop movement (gray = select/deselect function)

❏ Orientation (gray = select/deselect function)

⇨ “Orientation key” on page 38

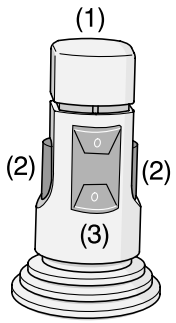
Stand/C-arm control module (SCM)

Stand/C-arm control modules are marked with a C-arm symbol.

With biplane systems the control modules for plane A are marked in light blue, and those for plane B in orange.

Stand/C-arm multifunction joystick

With the multifunction joystick the stand and C-arm positions can be adjusted by tilting the joystick in the required direction.



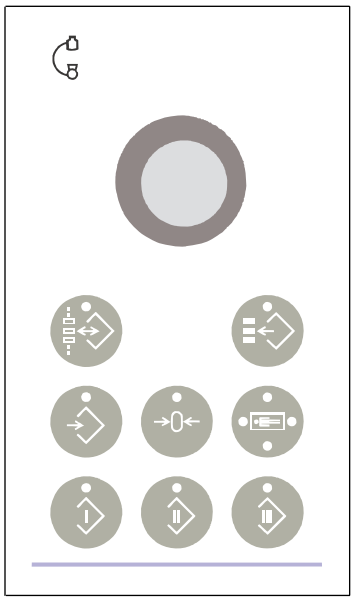
(View from the rear)

(1) Dead man's switch for releasing movements

(2) Buttons on each side with the same function:
switching over from C-arm angulation to stand swivel (floor stand), stand longitudinal movement (top stand), C-arm longitudinal movement and system lift (Artis dMP)

(3) Rocker switch on the back:
for lifting and lowering the FD (setting the SID)

Keys on the stand/C-arm control module (for plane A)



Stand/C-arm control module (single plane or plane A)

By pressing the keys on the stand/C-arm control module you can perform programmed movements:

❏ Programmed positions
(gray = select/deselect function)

❏ System positions
(gray = select/deselect function)

❏ Store position
(gray = select/deselect function)

❏ Zero stop
(gray = select/deselect function)

❏ Orientation (gray = select/deselect function)

⇨ “Orientation key” on page 38

❏ Direct positions I, II, III
(gray = select/deselect function)

Keys on the stand control module for plane B (Artis dBC/dBA only)

By pressing the key on the stand control module of plane B you can set synchronized movements:

❏ Biplane simultaneous angulation (gray = select/deselect function)

Orientation key

The orientation key causes movements to be made in the same direction as the joystick of the respective control console is tilted.

You can change the orientation of the control console by pressing the key for *more* than 3 seconds.

– The illuminated LED indicates the active position.

Assignment of the lit LEDs to the current position of the control console with respect to the patient table (patient is in the **Head First - Supine** position):

❏ Control console to the right of the tabletop
(Default position for systems with separate patient table,
Artis dMP default position if tabletop is mounted on the right side)

❏ Control console at the foot end of the tabletop

❏ Control console to the left of the tabletop
(Artis dMP default position if tabletop is mounted on the left side)

❏ Control console at the head end of the tabletop

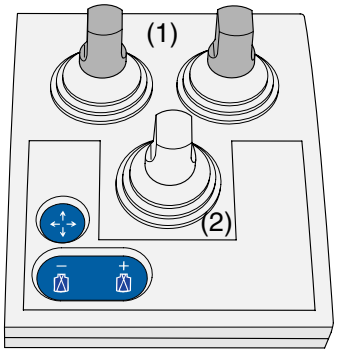
CareShuttle

You can activate the **CareShuttle** docking sequence by pressing the key for *less* than 3 seconds.

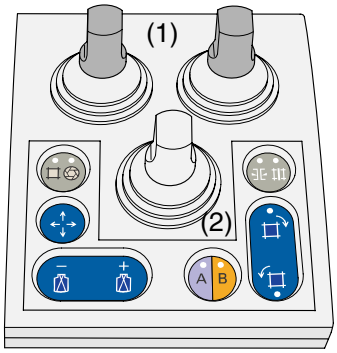
– The flashing LED indicates an active shuttle docking sequence.

⇨ Please refer to the **CareShuttle** Operator Manual.

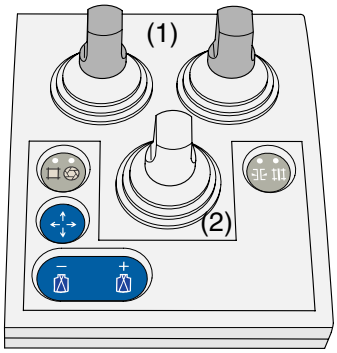
Collimator control module (CCM)



Card collimator control module (single plane)



Angio collimator control module (biplane)



Artis dMP collimator control module

Collimator versions

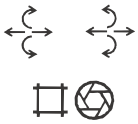
Depending on the system configuration and collimator version (Angio or Card collimator), the collimator control modules come in different versions.

Differences between Angio and Card collimator:

Function	**Angio collimator**	**Card collimator**
Diaphragm	rectangular and iris	rectangular only
Finger filter	two finger filters	one finger filter only
Wedge filter	one wedge filter	none
Additional keys		not available
Joysticks	❏ Lower joystick controls rectangular and iris diaphragm ❏ Left upper joystick controls left-hand finger filter. ❏ Right upper joystick controls right-hand finger filter.	❏ Lower joystick controls rectangular diaphragm ❏ Both upper joysticks control the same finger filter.

Collimator and filter joysticks

The three joysticks are used to set the primary collimator and filters by lateral tilting of the joystick:



(1) the wedge and finger filter(s) with the upper two joysticks

(2) the rectangular and iris diaphragm with the lower joystick

Pressing on the joystick resets the settings selectively.

Keys on the collimator control module

With the keys on the collimator control module you can select different collimator and filter functions and set the image input format:

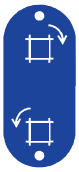
❏ Switch over rectangular/iris diaphragm[1]
(gray = select/deselect function)

❏ Switch over wedge/finger filter[1]
(gray = select/deselect function)

❏ Resetting collimator leaves and filter diaphragms simultaneously
(blue = will be executed immediately)

❏ Switch over image input format/zoom stage
(blue = will be executed immediately)

❏ Select plane[2]

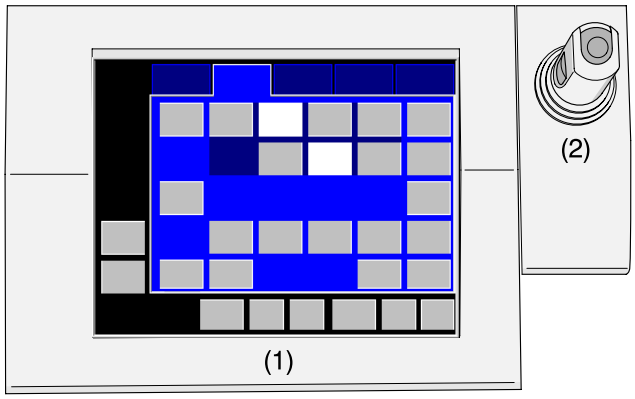


❏ Collimator/FD rotation[1] [3]
(blue = will be executed immediately)

[1] only with angio collimator
[2] only with biplane systems
[3] not available in Artis dMP

Touchscreen control

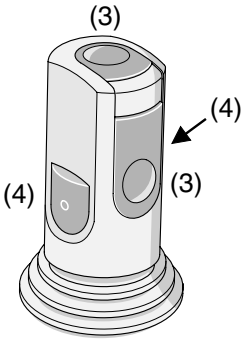
Selected functions of the imaging system can be operated using the *touchscreen control console*. It has a joystick which you can use like a mouse to move the cursor over the monitor(s).



(1) Touchscreen

(2) IS joystick

Imaging system joystick (IS joystick)



The imaging system joystick has four buttons, two of which have the same function:

(3) Selection button ("fire button") top and rear

(4) Function button left and right

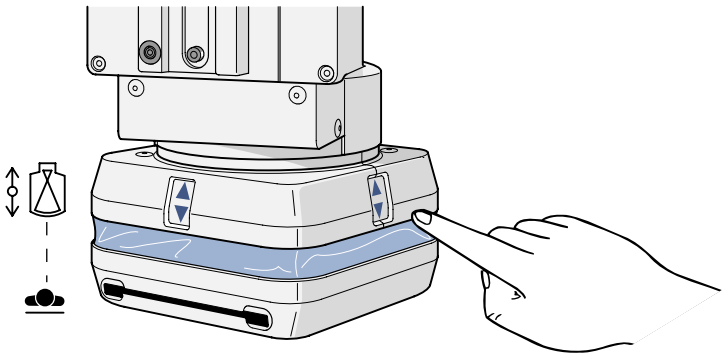
⇨ For further information refer to Part **System Operation**, Chapter **Operation via Touchscreen Control**.

Keys on the FD

Membrane keys for FD lift

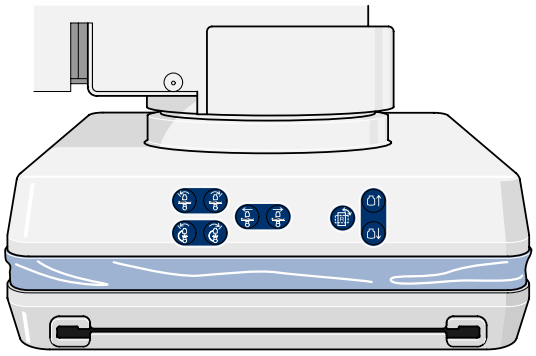
Artis dFC/dBC/dTC, Artis dBA (plane B)

The flat detectors (FD) are equipped with membrane switch buttons for setting the source-image distance (SID) from the focus of the X-ray source to the image receptor plane of the FD.



Membrane keys for C-arm and FD movements

Artis dFA/dTA/dMP, Artis dBA (plane A)



❏ C-arm rotation (cran/caud angulations)

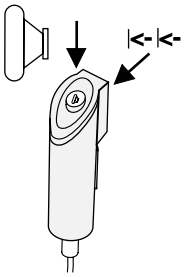
❏ C-arm orbital movement (RAO/LAO angulations)

❏ Longitudinal tabletop movement with stepping table
Longitudinal C-arm movement with Artis dMP/Artis dTC/dTA

❏ FD rotation (setting portrait/landscape)

❏ FD lifting and lowering the (setting the SID)

Handswitch



The handswitch has two operating elements:

❏ Acquisition button

With the acquisition button you can release acquisition series and single acquisitions as preselected in the acquisition program.

❏ Multifunctional button

|<-|<- Depending on the acquisition program selected, the multifunctional button has different functions:

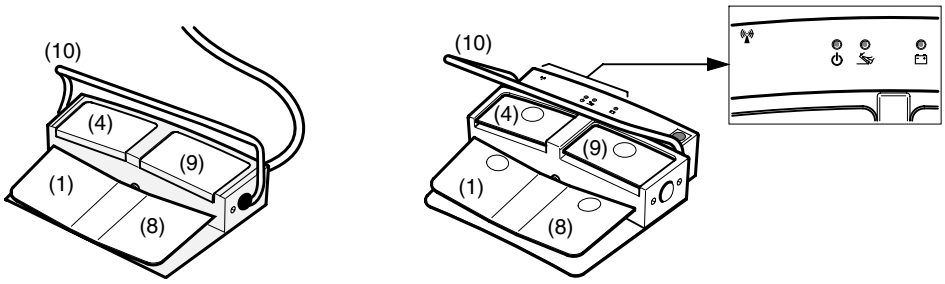
- ❏ In a program with manual variable frame rate, it is used to switch from one phase to the next.
- ❏ With a PERIVISION or PERISTEPPING program, it is used to release stepping in a filling run.
- ❏ In a DR-DYNAVISION or DYNAVISION program it is used to start the C-arm movement.

Footswitch

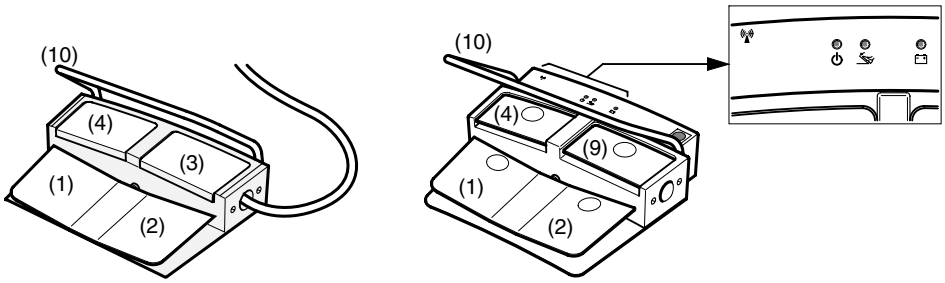
Standard or wireless footswitch

There are two single plane versions with 4 pedal functions and a biplane version with 8 pedal functions. The functions of the pedals can be configured by Siemens Service to your preference.

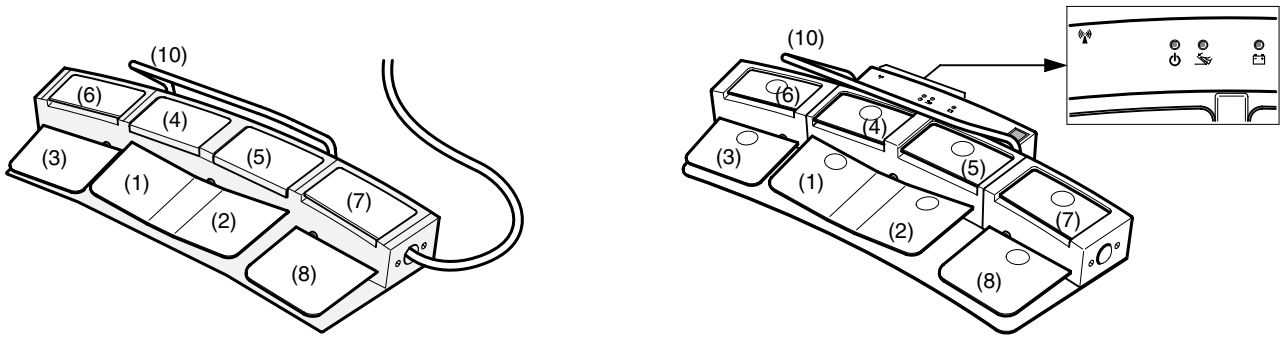
⇨ “Footswitch functions” on page 46



Single plane cable and wireless footswitch



Biplane CARD cable and wireless footswitch



Biplane Angio cable and wireless footswitch

Wireless footswitch

The wireless footswitch has the same functions as the standard footswitch without being connected by cable. The functions are activated via an RF transmitter.

In addition the footswitch can be configured for hands free movement with Voice Control.

The immanent advantages are easier cleaning and no tripping over cables.

⇨ Please observe safety information in part **Safety (Volume 1)**, chapter **User information**, "Use of wireless footswitches" as well as the **Wireless Footswitch Addendum**.

The wireless footswitch is active in a range of approximately 5 m (16 ft) around the table/stand, where the receiver is mounted. If the footswitch is in a wider range of the table, it may lose contact with the receiver and will then turn into an inactive mode.

Footswitch functions

The footswitch pedals can be configured by Siemens Service. The standard assignment of functions is as follows:

Symbol	No.	Standard function
	(1)-	Fluoroscopy generally
A	(1)	Fluoroscopy in plane A
B	(2)*	Fluoroscopy in plane B
	(3)*	Biplane fluoroscopy (plane A and plane B)
	(4)	Acquisition(s)
RDMP ON/OFF	(5)*	Switch Roadmap on/off
RDMP Reset A	(6)*	Reset Roadmap mask A
RDMP Reset B	(7)*	Reset Roadmap mask B
	(8)*	Tabletop brake
AUX	(9)*	Auxiliary switch*, e.g. room light on/off
-	(10)	Safety bracket (with switchoff function on Artis dMP)

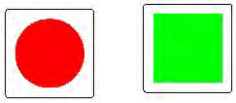
* configurable by Siemens Service

Cable with plug

On newer systems, the footswitch cable is equipped with a plug.

This symbol marks the appropriate plug for the footswitch at the base of the patient table.

Signs and indicators on the wireless footswitch



The wireless footswitches are marked with a colored sign of different shape to avoid a mix up for installations with more than one wireless footswitch.

The same marks are attached to the respective table and room during installation.

Status LEDs

There are 3 LEDs showing the status of the footswitch.

❏ Activity LED
LED lights: Footswitch is on and is in active mode.
LED off: Footswitch is inactive.
– It is too far away from the table
– The Artis system is switched off
– The batteries are completely discharged
– The Footswitch is in “sleep mode”. Press a pedal swiftly to activate it again.

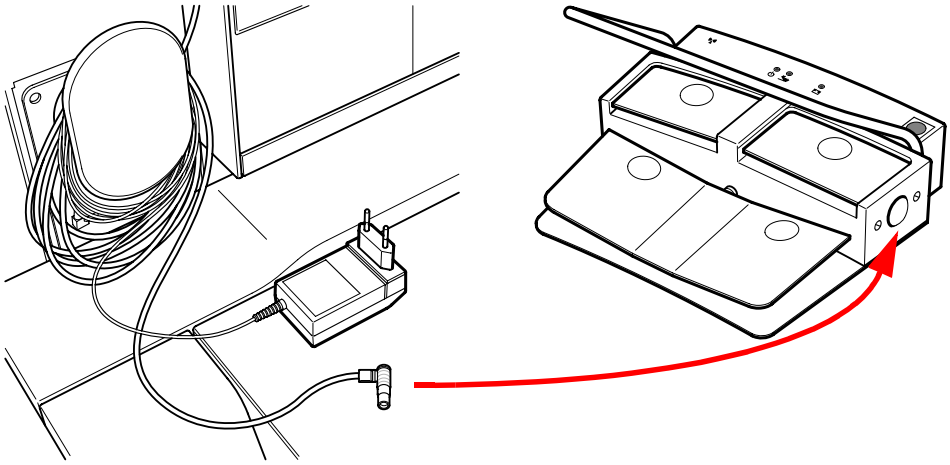
❏ Transmission LED lights: Any footswitch pedal is being pressed.
On Artis dMP:
If the safety bracket is activated, all movements stop and the LED turns on.

❏ Battery LED
– LED off: Battery is sufficiently charged, footswitch is not connected to the power adapter.
– LED flashing yellow: Battery needs charging, remaining capacity is < 4h.
– LED lights yellow: Footswitch is connected to the power adapter, batteries are being charged.
– LED lights green: Footswitch connected to the power adapter, batteries are fully charged.

This symbol marks an RF transmitting component.

Power adapter for charging the wireless footswitch

It is recommended to connect the power adapter to the wireless footswitch every day after deployment.



Power adapter fpr charging the batteries of the wireless footswitch

If the wireless footswitch needs charging during a patient procedure, simply connect the power adapter to it. The cable length of 7 m allows charging during the procedure.

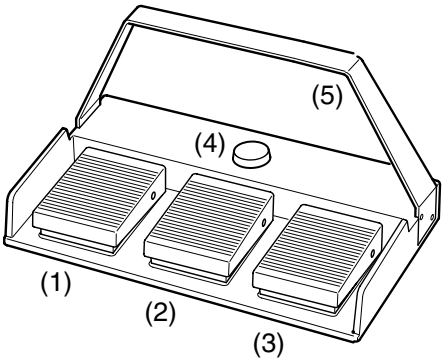
Never use another charging device than the power adapter delivered with the wireless footswitch.
The usage of another charging device may cause severe damage to the wireless footswitch or may result in hazards for the patients when the wireless footswitch is recharged during operation.

HT-S footswitch

The HT-S footswitch can replace the standard footswitch.

The HT-S footswitch must not be used with Artis dMP.

This footswitch version is equipped with three pedals and one exposure release button.



(1) Fluoroscopy (in plane A)

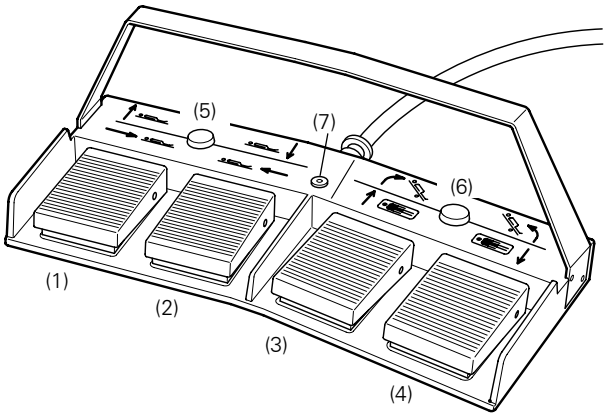
(2) Programmable, ⇨ page 46

(3) Programmable, see "Footswitch functions" on page 46

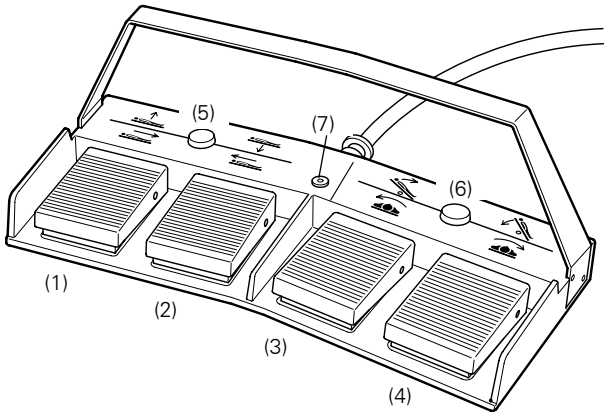
(4) Acquisition

(5) Safety bracket

Footswitch control for table with lateral tilt



Footswitch control, older version



Footswitch control, version with new symbols

(1) Tabletop movement footward / upward

(2) Tabletop movement headward / downward

(3) Table tilt lateral left / reverse Trendelenburg

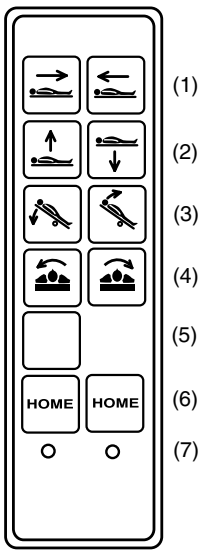
(4) Table tilt lateral right / Trendelenburg

(5) Switchover tabletop longitudinal movement / table height

(6) Switchover table tilt lateral / Trendelenburg

(7) Display for active functions
- Display lit:
  Tabletop longitudinal movement and table tilt are active
- Display not lit:
  Table height and Trendelenburg table tilt are active

Manual control for table with lateral tilt



You can adjust the height and tilt of the table and return the table to the zero position by manual control.

(1) Tabletop longitudinal movement

(2) Table height

(3) Table tilt Trendelenburg

(4) Table tilt lateral

(5) Without function

(6) Table tilt zero position

(7) LEDs for displaying the zero position

Manual control also works during a power failure.

Monitor suspension system

Depending on the application, your system can be equipped with a monitor suspension system with up to 8 CRT or LCD monitors:

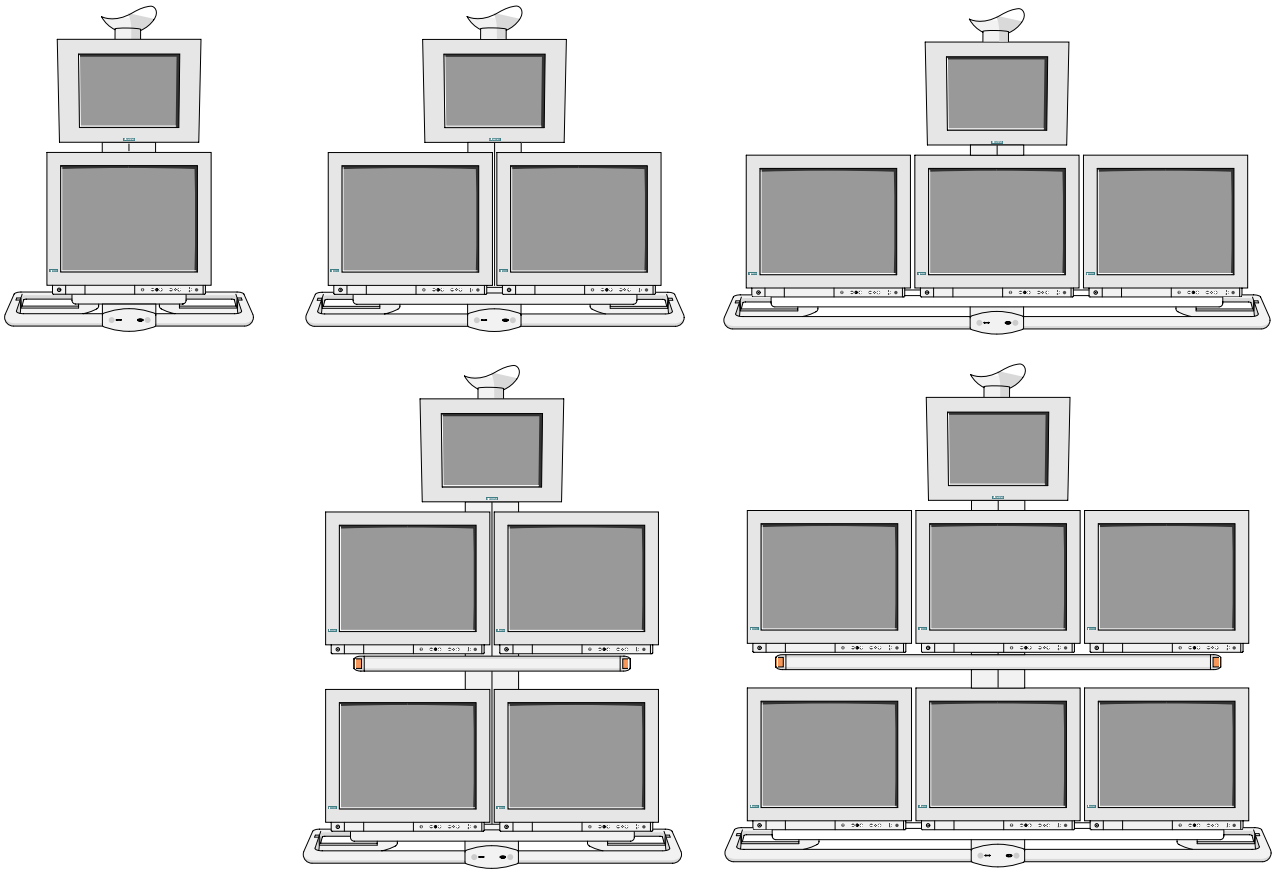
- ❏ 1 CRT or LCD monitor: single plane, without reference image monitor
- ❏ 2 CRT or LCD monitors: single plane, with reference image monitor or biplane
- ❏ 3 CRT or LCD monitors: single plane, with reference image monitor and, e.g., ECG monitor
  or biplane without reference image monitors, but with ECG monitor
- ❏ 4 CRT or LCD monitors[1]: biplane with one reference image monitor each
- ❏ 6 CRT or LCD monitors[1]: biplane with two reference image monitors each
- ❏ 8 LCD monitors[1]: biplane with two reference image monitors each

The availability of display modes depends on how many reference image monitors your system is equipped with.

[1] An additional LC display can be attached on the side.

Using the handle, the monitor suspension system can be moved rotated and adjusted in height.

Suspension system with SIMOMED CRT monitors

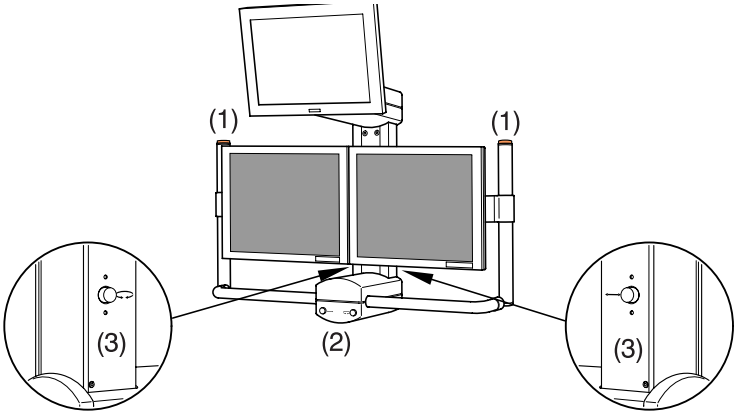


CRT monitors ⇨ Chapter **Equipment in the Control Room**, "SIMOMED monitor(s)"

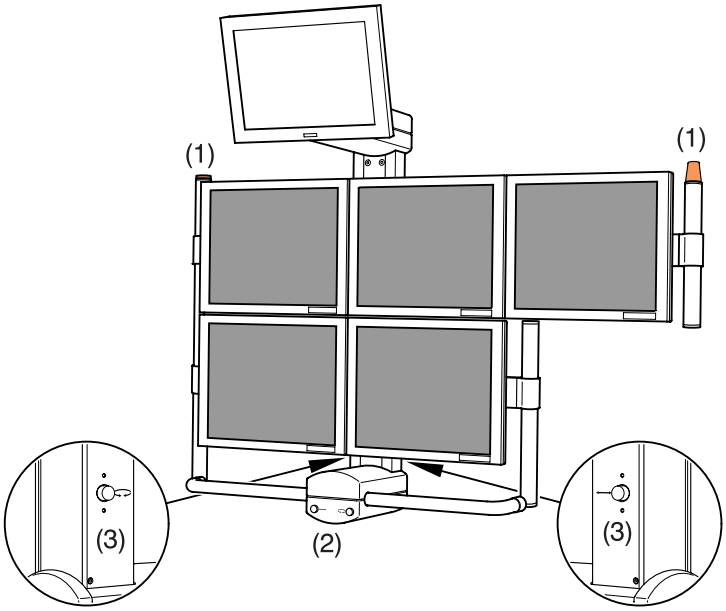
Suspension system with LCD monitors

As an alternative to the monitor suspension system, it is possible to install a suspension system with 1, 2, 3, 4, or 6 17" or 18" LCD monitors.

The versions for 4 and 6 displays can be extended by the 'additional 17" color display'.



Example of DCS 2 with data display

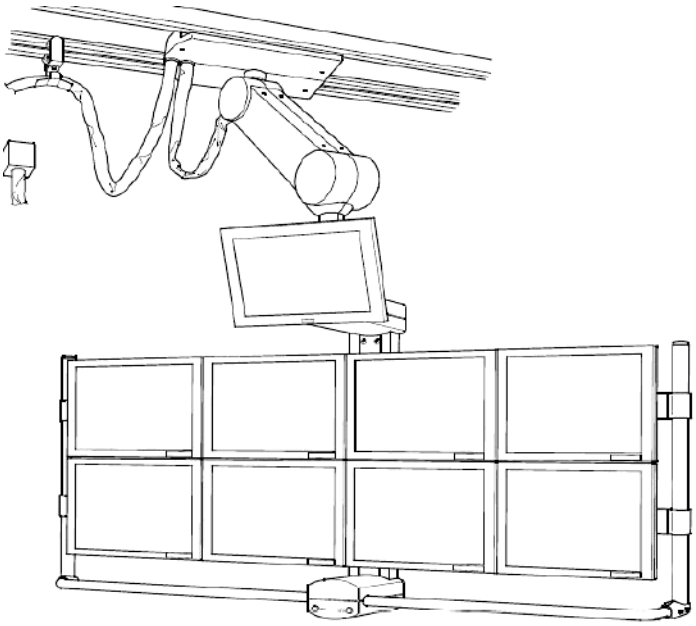


Example of DCS 4 with 'additional 17" color display' and with data display

(1) "Radiation ON" lamp

(2) Keys on front

(3) Keys on side

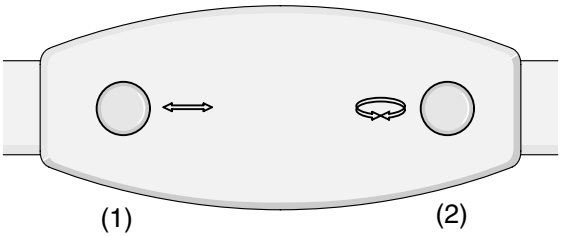


Suspension system with 8 LCD monitors

LCD monitor(s) ⇨ Chapter **Equipment in the Control Room**, “LCD monitor(s)”.

Handle and keys on the suspension system

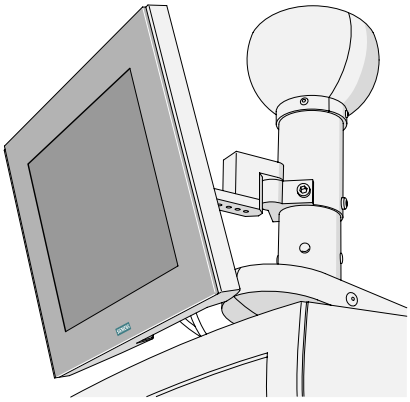
Underneath the monitors there is a handle for moving the monitor suspension system. There you will find the following keys (also on the side for the suspension system with LC displays).



(1) Key for longitudinal travel
– Key pressed: Longitudinal movement enabled - rotary movement disabled.

(2) Key for rotation
– Key pressed: Rotary movement enabled - longitudinal movement disabled.

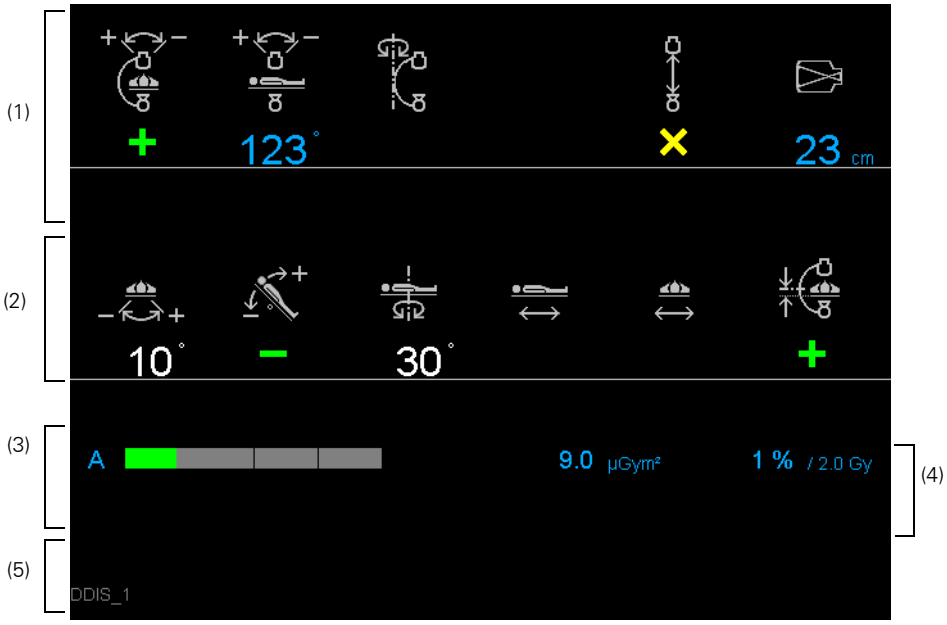
Data display



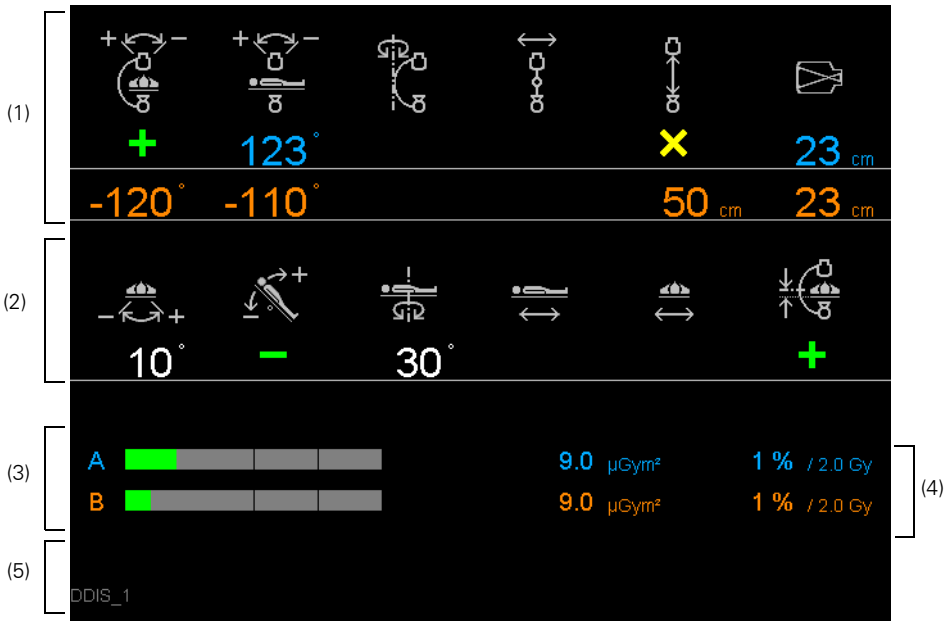
The data display is attached above the monitors and can be swiveled and tilted.

The data display shows essential position and acquisition data as well as system messages.

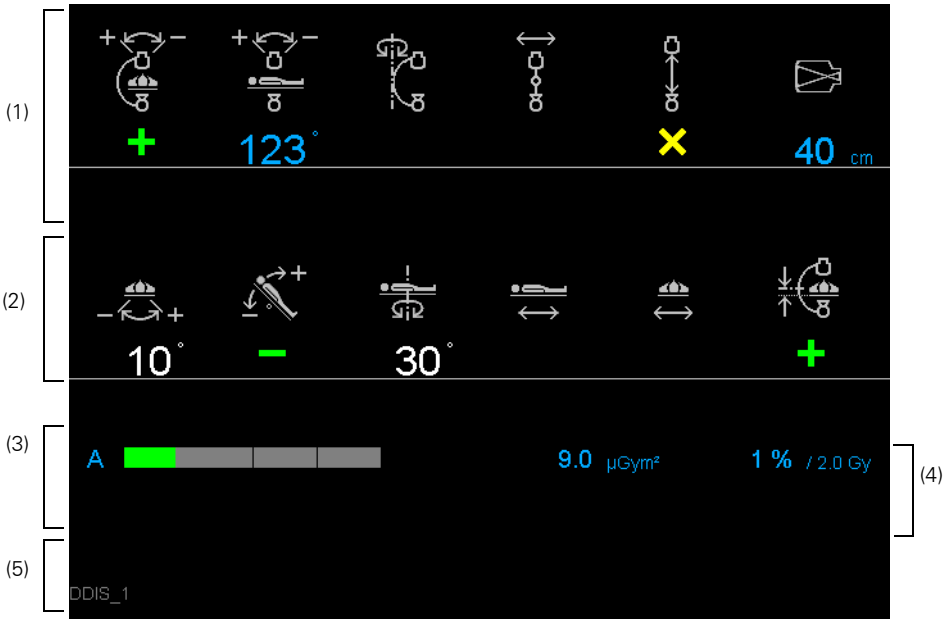
Readings on the data display



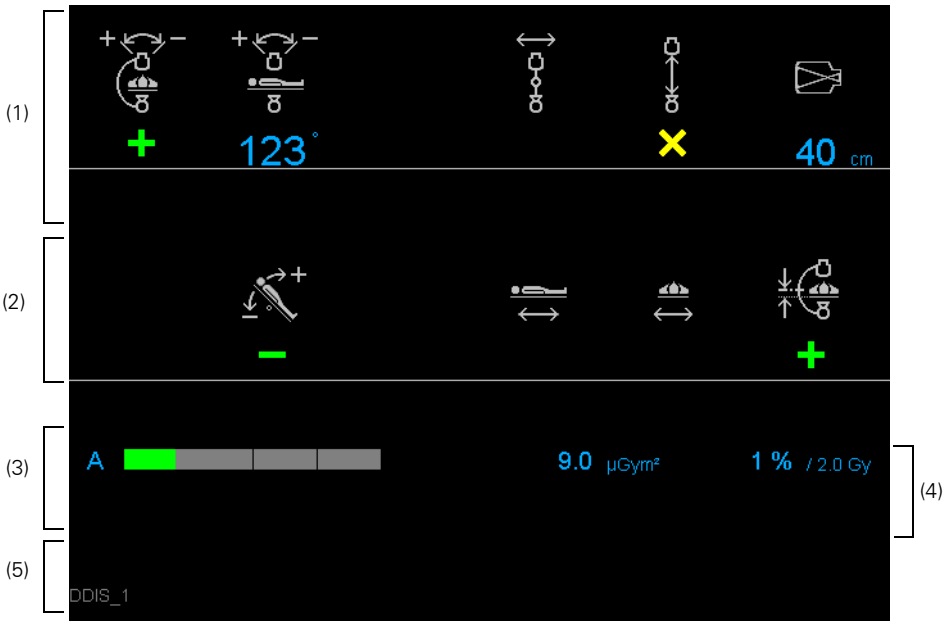
Example Artis dFC/dFA



Example Artis dBC/dBA



Example Artis dTC/dTA



Example Artis dMP

(1) Information about the stand and C-arm positions[1]

(2) Information about the table position

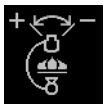
(3) Tube load[1]

(4) Dose applied[1]

(5) System and error messages

With biplane systems the displays for plane A are shown in light blue, those for plane B in orange.

Stand/C-arm position



❏ LAO/RAO angulation angle

❏ CRAN/CAUD angulation angle

The angle displays indicate the C-arm angulation (central beam angle) in relation to the patient (patient angle), taking into account the patient position entered. That is, if the position is changed, the displays also change.

❏ Angle of stand swivel about vertical axis Artis dTC/dTA

❏ Longitudinal stand/C-arm position Artis dTC/dTA/Artis dMP

❏ SID: Source-image distance

❏ FD zoom: diameter of the active FD input format

[1] with biplane systems separate for both planes

Table position

The data refer to the current patient position relative to the patient.
In Artis dMP, the position of the C-arm also influences the coordinates of the table. Example: (Artis dMP with right mounting)
Tabletop to the right has the same effect as C-arm to the left, with **Head First - Supine** the FD will move toward the head of the patient, the longitudinal position of the tabletop increases in the positive direction.

⇨ "Patient coordinates" on page 61

❏ Angle of lateral table tilt

❏ Angle of the (reverse) Trendelenburg table tilt

❏ Angle of table swivel about vertical axis Artis dTC/dTA

❏ Longitudinal position of the tabletop
"0" is displayed if the tabletop is in the end position at the foot end.

❏ Transverse position of the tabletop
"0" is displayed if the center of the tabletop coincides with the beam center.

❏ Isocenter-tabletop distance (T.O.D.)

The data refers to the top edge of the *tabletop*.
The mattress must be taken into account additionally.

Values

The following displays can be configured by Siemens Service:

No movement — The currently set numeric values of the system position are displayed below the symbols if required.

Movement — If movement is in progress, only the values that are changing are displayed to facilitate operation.

Collision — If a collision has occurred, a "navigation aid" is displayed instead of the current value:

❏ A movement in the **+** direction will eliminate the collision.

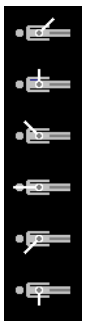
❏ A movement in the **-** direction will eliminate the collision.

❏ An **x** indicates that movement is not possible.

Programmed positions

If **programmed positions** are selected, additional symbols are displayed that symbolize the stored positions.

Examples single plane (Artis dFC/dFA):



❏ **Left Side**

❏ **Left Side, Table Rotated**

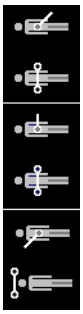
❏ **Patient Transfer**

❏ **Head Side**

❏ **Right Side, Table Rotated**

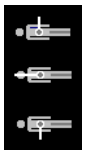
❏ **Right Side**

Examples biplane (Artis dBC/dBA):



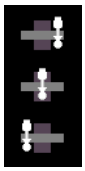
- ❏ Floor Stand **Left Side**
- ❏ Top Stand in Working Position
- ❏ Floor Stand **Left Side, Table Rotated**
- ❏ Top Stand in Working Position
- ❏ Floor Stand **Right Side, Table Rotated**
- ❏ Top Stand in Parked Position

Examples Artis dTC/dTA:



- ❏ **Left Side**
- ❏ **Head Side**
- ❏ **Right Side**

Examples Artis dMP:



- ❏ C-arm Foot Side
- ❏ C-arm Center
- ❏ C-arm Head Side

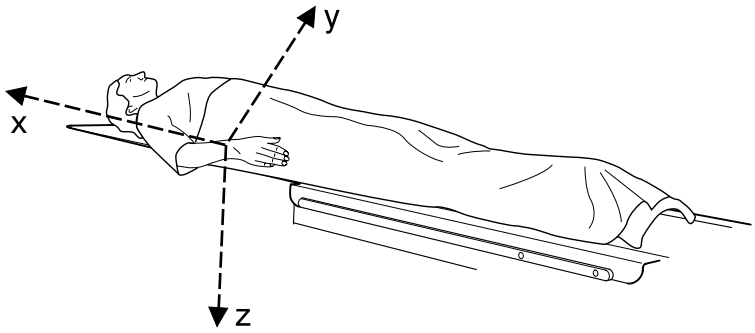
Protected positions

Programmed positions can be protected against deletion or overwriting by Siemens Service.

- ❏ Such positions are marked with a lock symbol.

Patient coordinates

The values shown on the data display refer to the *patient position currently entered*. A special coordinate system is used for that. It starts on the upper surface of the tabletop, that is, on the back of a supine patient, on the abdomen of a prone patient.



Example of the patient-related coordinate system for the supine position

Lateral position Be careful if the patient is in the *lateral position*: Because the coordinate system is attached to the patient, changing the table height changes the lateral value (y-axis). Moving the tabletop in the transverse direction changes the dorsal value (z-axis), the coordinates being in the center of the transverse direction.

Isocenter key With the **Isocenter** key, you can program the table to stop automatically when the isocenter is reached.

The coordinates are also switched over:

- ❏ Selecting the **Isocenter** key (LED lights up): The coordinates x, y, z are set to zero. Now relative coordinates are displayed.
- ❏ Deselecting the **Isocenter** key: The coordinates x, y, z are switched over to the standard origins of the coordinate system.

Siemens Service can configure the **Isocenter** *key to retain the isocenter during angulations if the function is active.*

Standard origins The standard origins for a patient in the normal position (**head first - supine**) are defined as follows:

- ❏ x: The tabletop is in its final longitudinal position at the foot end.
- ❏ y: The tabletop is in the central transverse position.
- ❏ z: The surface of the tabletop is in the isocenter.

Tube load

Single plane system

Biplane system

❏ Bar display for the current thermal load on the X-ray tube assembly

HU This display (HU = Heat Units) indicates the thermal condition of the anode.

If the red range is reached (approx. 75%)[1], an acoustic signal sounds as a warning of overload. You can continue to perform fluoroscopy. However, we recommend selecting pulsed fluoroscopy with a low pulse rate so that the anode cools down quicker.

Acquisition series are not blocked automatically. However, we recommend selecting an acquisition program with a low frame rate, if possible.

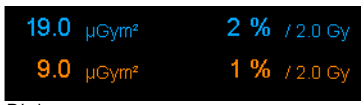
When the HU threshold value is exceeded, the overload computer of the tube assembly is activated, because the tube is then being operated within the range of increased wear.

Repeated exceeding of the HU threshold value can reduce the service life of the tube.

Overload can cause permanent damage to the tube. This will void any warranty claims.

Dose[2]

Single plane system



Biplane system

❏ Dose applied

⇨ Part **Safety (Volume 1)** and Part **Examination**, Chapter **Preparing the Examination - Fluoroscopy - Acquisition**, "Monitoring the dose".

[1] The threshold at which the audible signal sounds depends on the X-ray tube and is configured by Siemens Service.
[2] mandatory in the European Union

Messages

Example

- ❏ Stand/table messages
- ❏ System status messages

⇨ Part **Troubleshooting**, Chapter **System Messages / Troubleshooting**

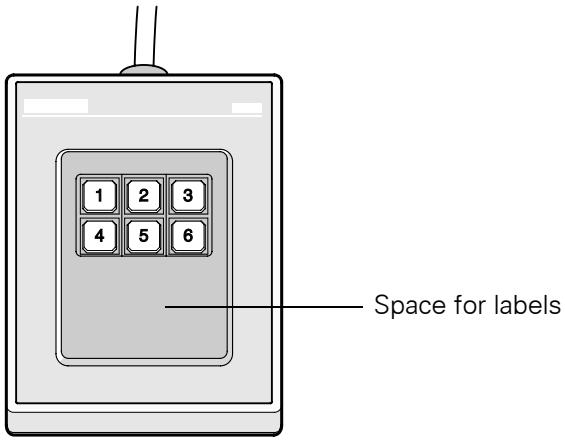
No communication

For example, on system startup or in the case of a fault, it may be possible that the data display has no communication with the rest of the system.

Multi Modality Viewing control unit

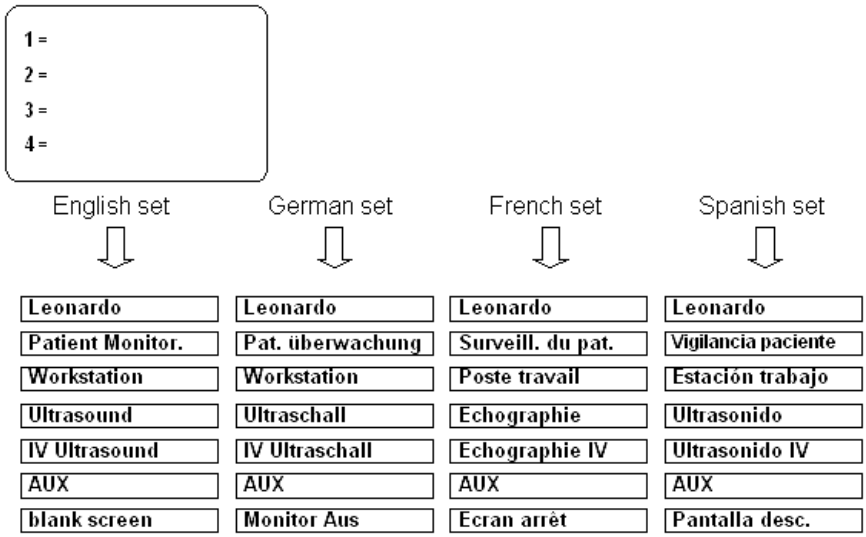
The Multi Modality Viewing (MMV) Interface enables the display of different modalities and their output signals in the examination room on a separate color monitor.

For switching between the modalities there is a control unit which is mounted on the system console in the control room.



Labels

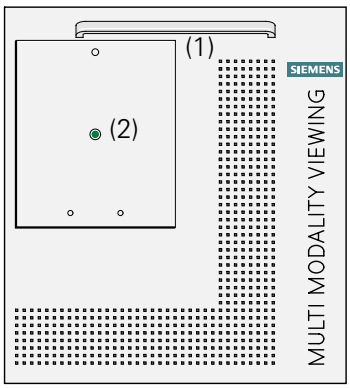
The buttons 1-4 can be allocated different functions. The buttons 5 and 6 cannot be used. The following functions are available and can be programmed by Siemens Service:



The supplied labels can be attached to the control unit in the space below the operating buttons.

Interface unit

The AXIOM Artis system can be connected to the MMV operating unit with an interface unit. It is installed in the control room; it processes the control signals of the MMV operating unit and the video signals of the connected modalities.



(1) Handle

(2) Green "ready" lamp

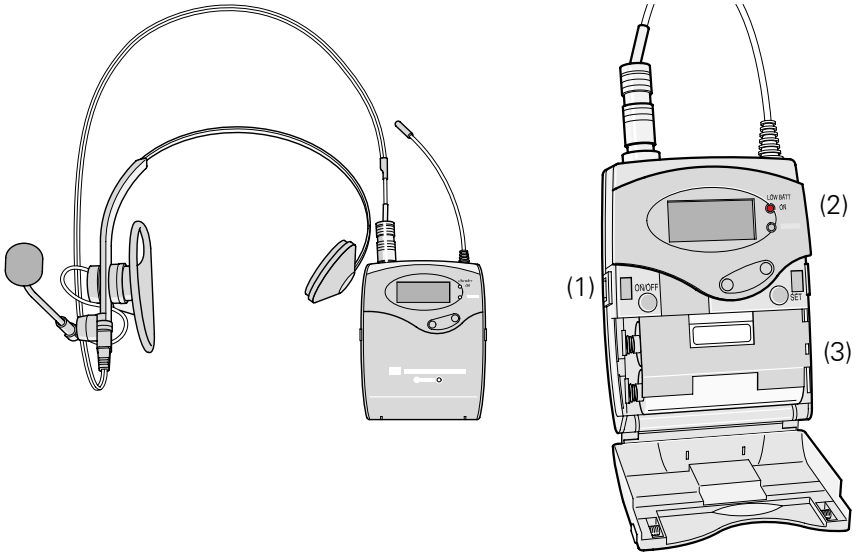
The interface cannot be operated. It is connected to the room OFF and is also switched on and off with it.

The handle at the front of the interface unit is only suitable for lifting the unit, not for carrying it.
The cooling openings at the rear must not be covered.

Voice control units

Headset

The voice control consists of a headset with microphone and a transmitter.



Headset and Transmitter (ready to wear, open for switching on)

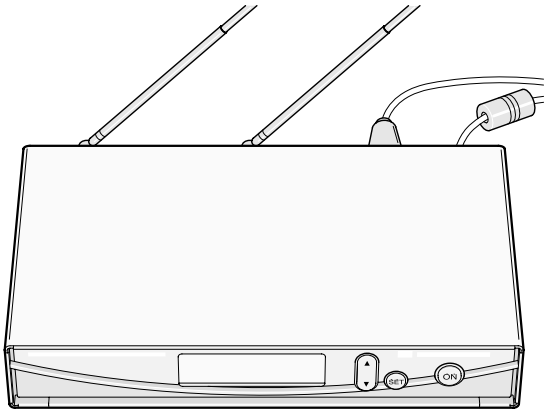
(1) On/off button

(2) On/battery indicator LED

(3) Battery pack

The other components, i.e. receiver and PC, have been installed in the examination/control room and do not need to be operated.

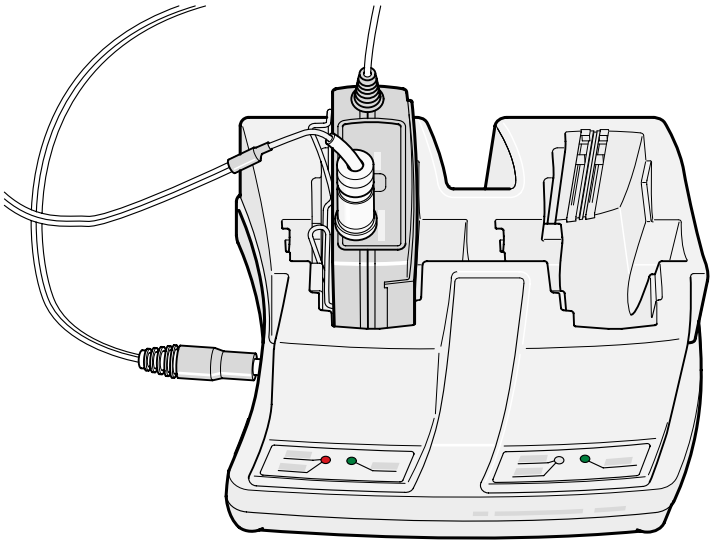
Receiver



The receiver has been installed in the examination room. It has been set up by Siemens Service and does not need any operation.

The display can change between red and green display. A green display shows proper wireless connection to the transmitter. A red display shows that there is no wireless connection to the transmitter.

Charging station



- ❏ Red LED: Loading
- ❏ Green LED: Transmitter is fully charged

The charging station must be connected to a power outlet, which is not turned off by the system.
To charge the headset it needs to be snapped into the charging station.

Acoustic signals

With certain functions, a continuous or beeping sound indicates the operating state of the system.

Events The following events are displayed:

For movements
- ❏ If a C-arm is moved into a collision zone.
- ❏ If a collision sensor has responded (collision).

For acquisitions End of acquisition[1]
- ❏ If an acquisition was started by an operating element that was released too early.
- ❏ After a successfully completed acquisition series.
- ❏ If an acquisition series was interrupted because of an error.

For fluoroscopy
- ❏ Each time the set fluoroscopy time has elapsed.
- ❏ During high-contrast fluoroscopy

For radiation
- ❏ If the tube load is too high or the temperature switch of the tube has responded.

Priorities If two events occur simultaneously, only the more important one of the acoustic signals is output. Six different signals are used for this purpose:

Event	Signal	Priority
Collision (collision sensor)	Strong beep	1
The set fluoroscopy time has elapsed	Ringing signal	2
Tube load is too high or temperature switch has responded	Beep	3
During high-contrast fluoroscopy	Bell	4
Movement within the collision zone	Short beeps	5
End of acquisition[1]	Beep	10

[1] can be configured, depending on national regulations

"Plane ready for radiation" displays

Single plane system

The "plane ready" display lamp lights up (green), then the system is ready for radiation.

Biplane system

The floor and top stands each have a "plane ready" display lamp. If the display lamp lights up (green), then the relevant plane is ready for radiation.

⇨ Chapter **Equipment in the Examination Room**, "The floor stand (Artis dFC/dFA and Artis dBC/dBA)" on page 20 and "The top stand (Artis dBC/dBA)" on page 22

If the display is not lit, fluoroscopy and acquisition are not possible in this plane.

The "plane ready" displays only indicate that the plane is ready. If radiation is still not released, it may be because of an open door contact, etc.

⇨ Also see Part **Troubleshooting**, Chapter **System Messages / Troubleshooting**, "... if no radiation is released"

Plane A

The green display on the floor stand (Artis dFC/dFA) is normally always lit, even in "bypass fluoroscopy" mode (radiation can be released).

⇨ Also see Part **Troubleshooting**, Chapter **System Messages / Troubleshooting**, "Bypass fluoroscopy (emergency operation)"

Plane B

The green display on the top stand (Artis dBC/dBA) is lit during normal operation. It is not lit in the following cases (radiation cannot be released):

- ❏ If the top stand is in the PARK position.
- ❏ In "bypass fluoroscopy" mode: In this case fluoroscopy is only possible in plane A.

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System Operation

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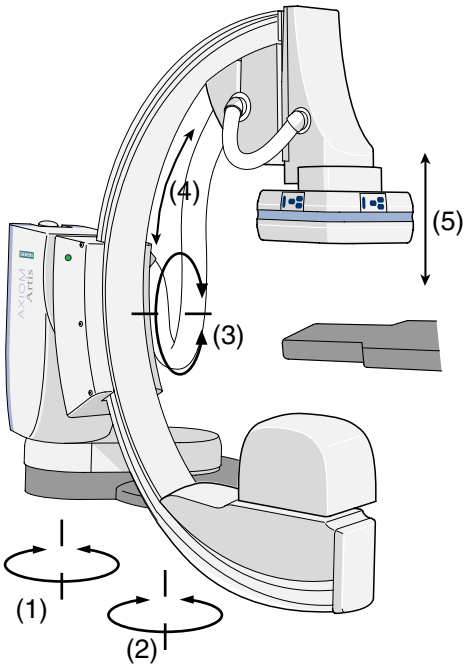
Movement possibilities

This section provides a brief overview of general movement possibilities (degrees of freedom) of the units.

Movements of the floor stand (Artis dFC/dFA and Artis dBC/dBA)



Example: Artis dFA/dBA floor stand

(1) Stand swivel

(2) Stand rotation (Multispace F only)

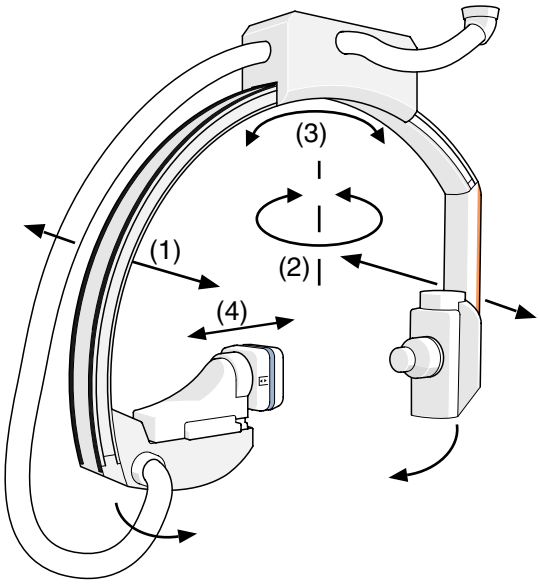
(3) C-arm rotation (cran/caud angulations)

(4) C-arm orbital movement (RAO/LAO angulations)

(5) FD lift

All movements are motor-driven with the exception of stand rotation.

Movements of the top stand (Artis dBC/dBA)



Example: Artis dBC top stand

(1) Stand longitudinal movement (on ceiling rails)

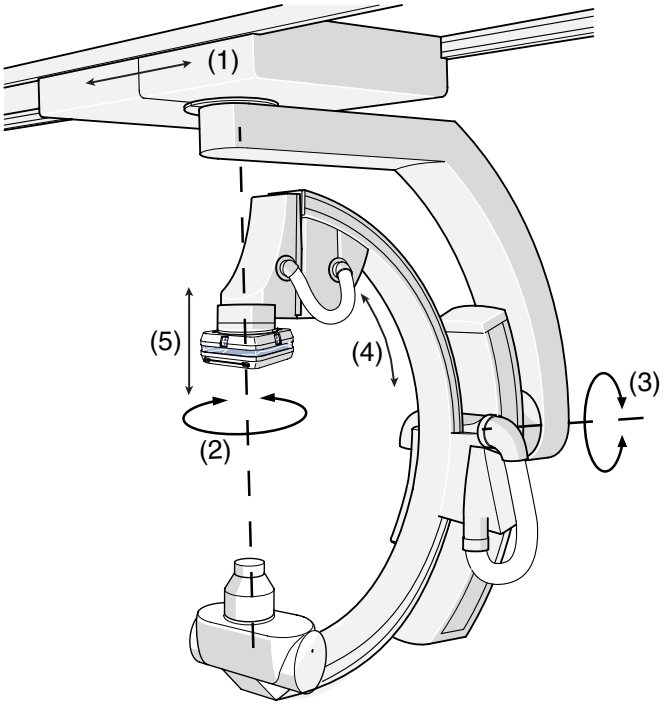
(2) C-arm rotation (cran/caud angulations)

(3) C-arm orbital movement (RAO/LAO angulations)

(4) FD lift

All movements are motor-driven.

Movements of the stand/C-arm (Artis dTC/dTA)



Example: Artis dTC stand/C-arm

(1) Stand longitudinal movement (on ceiling rails)

(2) Stand swivel/rotation

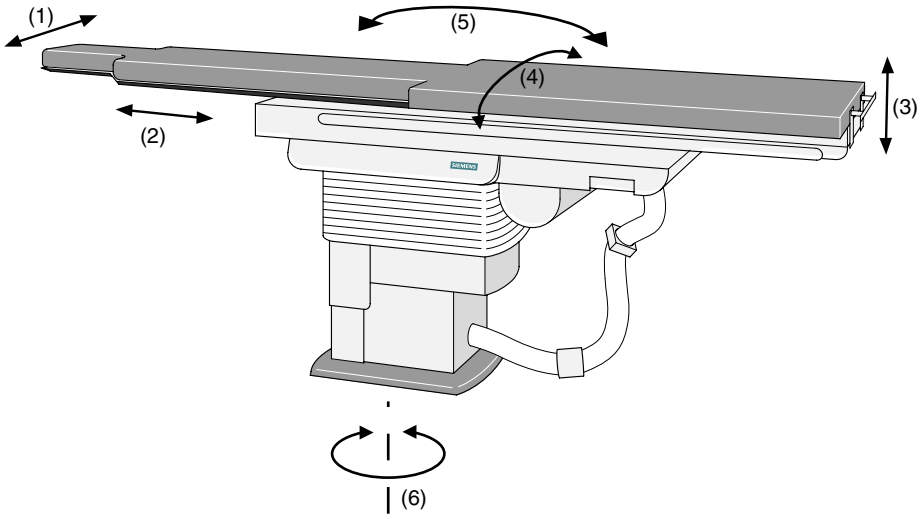
(3) C-arm rotation (cran/caud angulations)

(4) C-arm orbital movement (RAO/LAO angulations)

(5) FD lift

All movements are motor-driven.

Movements of the floor-mounted patient table



(1) Tabletop transverse movement (manual)

(2) Tabletop longitudinal movement (manual or servo-assisted)

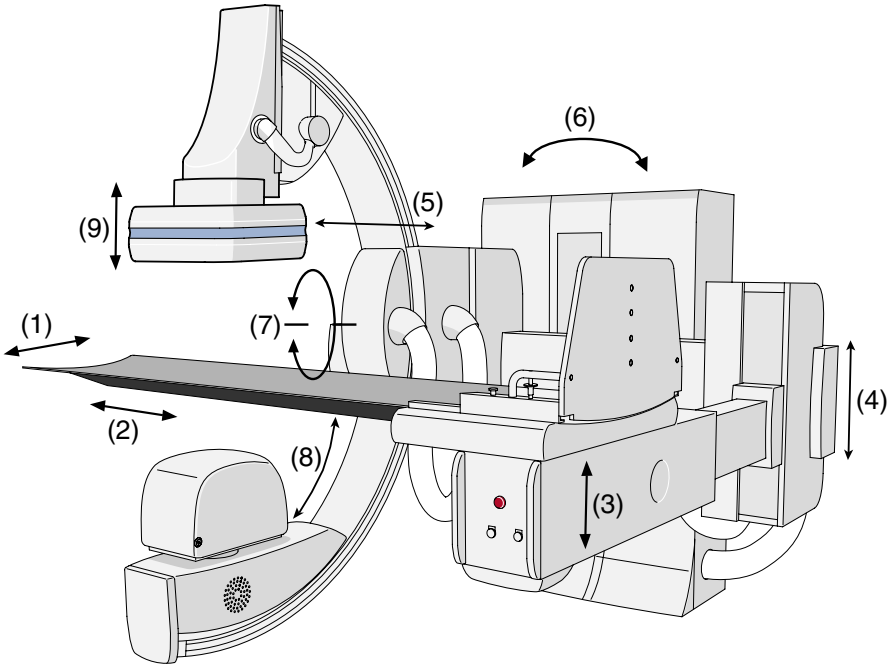
(3) Table lift (motorized)

(4) Table tilt lateral (motorized)

(5) (Reverse) Trendelenburg table tilt (motorized)

(6) Table swivel (manual)

Movements of the stand/C-arm/patient table (Artis dMP)



(1) Tabletop transverse movement

(2) Tabletop longitudinal movement

(3) Table lift

(4) System lift

(5) C-arm longitudinal movement

(6) Table tilt

(7) C-arm rotation (cran/caud angulations)

(8) C-arm orbital movement (RAO/LAO angulations)

(9) FD lift

All movements are motor-driven.

Basic positions of the units

General basic positions

C-arm

A C-arm can be in the following basic positions:

- ❏ C-arm rotation 0°
- ❏ C-arm angulation 0° (FD overtable position)

And with Artis dMP:

- ❏ C-arm rotation 180° (FD undertable position)
  In this position the C-arm is rotated through 180° so that the FD is under the patient.

Patient table

The patient table can be in the following basic positions:

- ❏ Table tilt horizontal (0°)
- ❏ Table height isocenter
- ❏ Tabletop center position (Artis dMP only)

Isocenter

The isocenter is the center of rotation, the fixed point of a C-arm. If an organ is in this center of rotation, the image of the organ remains in the same place on the monitor during C-arm angulations.

⇨ "Stopping in the isocenter" on page 24.

Stopping in the basic positions

By pressing a button, you can release stops for C-arm movements beyond a basic position.

- ◆ Press the **zero stop** button.
  – The LED lights up.
  – Movements stop at the basic positions.
- ◆ If you now release the button and operate the operating element again, movement is resumed.

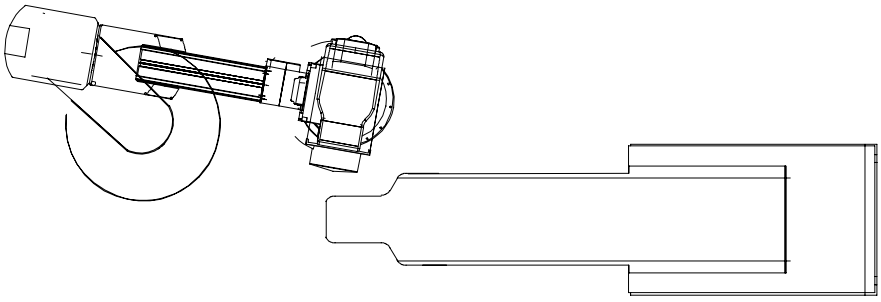
No stop

- ◆ Press the **zero stop** button again.
  – The LED goes out.
  – Movements are executed continuously beyond the basic positions.

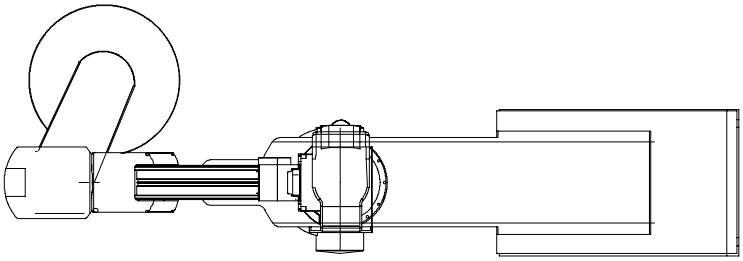
Positions of the floor stand (Artis dFC/dFA and Artis dBC/dBA)

The floor stand of an Artis dFC/dFA or Artis dBC/dBA system can be in the following basic positions:

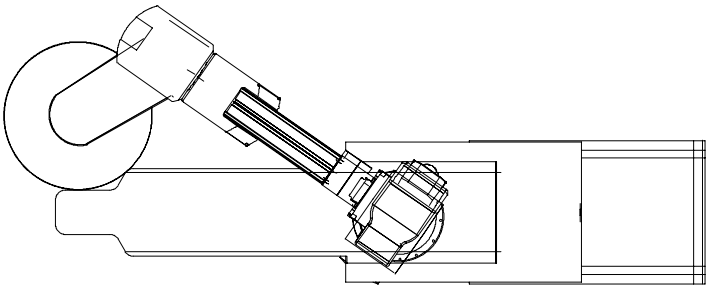
❏ **Patient Transfer Head Side**



❏ **Head Side**

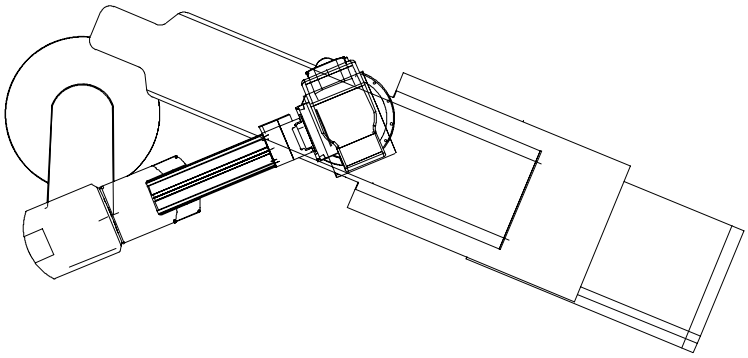


❏ **Left Side** (with right-side patient access)

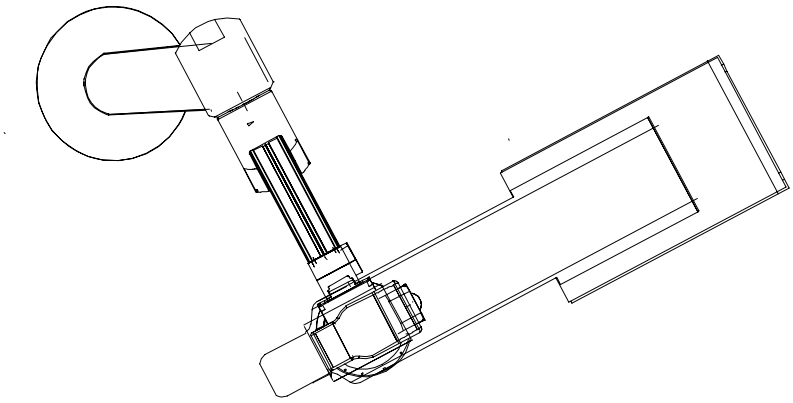


⇨ "Moving to system and programmed positions" on page 40

❑ **Right Side, Table Rotated** (with left-side patient access)

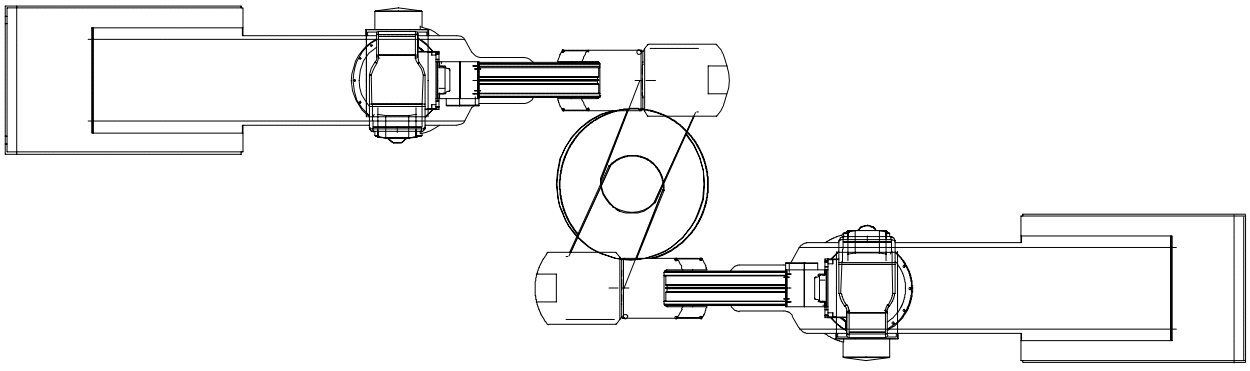


❑ **Left Side, Table Rotated** ("OR position")



⇨ "Movement to or from a position with swiveled table (Multispace F only)" on page 51

❑ **Swinglab** position with two patient tables



Left: room 1, right: room 2

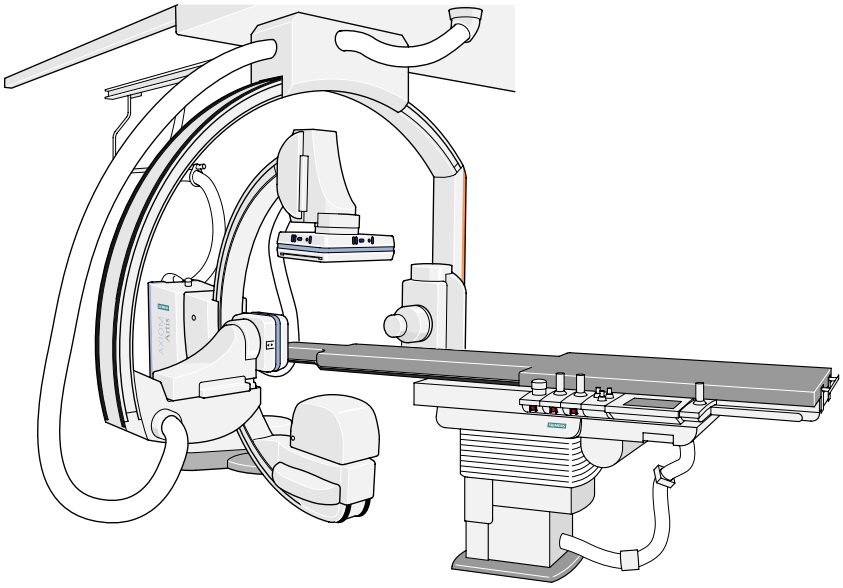
Curtain 1 protects the remaining area of room 2 when room 1 is active.

⇨ "Swinglab operation" on page 53

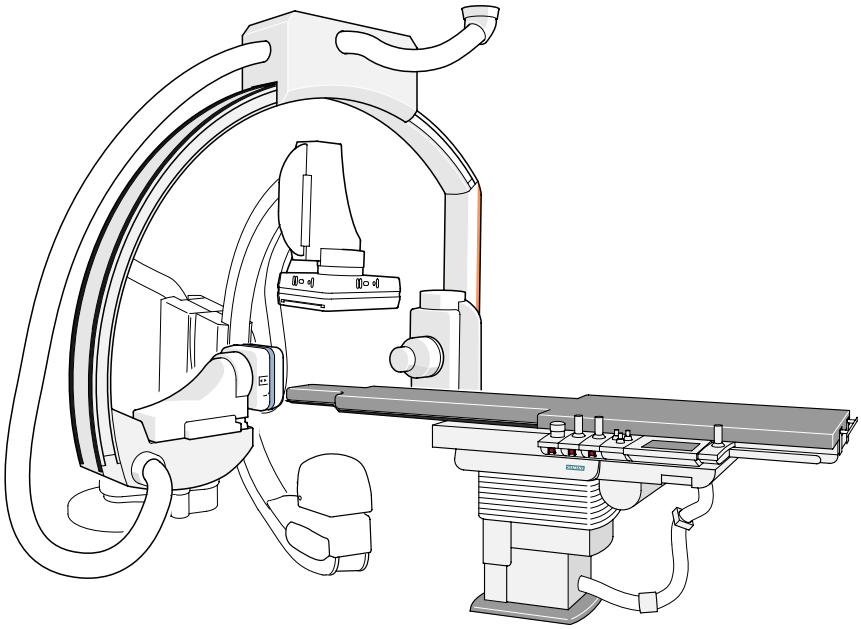
Positions with the top stand (Artis dBC/dBA)

The stands of an Artis dBC/dBA system can be in the following further basic positions:

❑ **Biplane Head Side**



❑ **Biplane Left Side**



Initiating unit movements

Important information on unit movements

Movements are motor-driven, that is, when you operate an operating element (e.g. joystick), the system performs a movement.

In an emergency, e.g. if there is a power failure, the units can also be moved manually by applying sufficient force.

Artis dFC/dFA, Artis dBC/dBA:
The patient table with lateral tilt can be returned to the original position in the event of a power failure with the help of the integrated emergency power supply.
If there is a power failure, the emergency power supply is switched on after some time.
Now you can execute table movements for about 5 minutes depending on the battery charge and aging state.

Caution

Unit movements

Risk of collision, risk of injury to patient or operator, risk of damage to unit parts.

It is the responsibility of the operator to ensure that unit movements are released only if it is certain that neither the operator, the patient, third parties nor other pieces of equipment can be endangered by these movements.

- *Always* pay attention to possible collisions during unit movements.
- Make sure that nobody is standing inside the danger area.
- Remove *any* objects or accessories from collision area, e.g. injector or infusion stand.

⇨ Please also observe the part **Safety (Volume 1)**

The current coordinates are shown on the data display during the movement.

⇨ Part **System Overview / Operating Elements**, Chapter **Operating Elements and Displays in the Examination Room**, "Readings on the data display"

Collision protection

Safety equipment

The systems are equipped with a number of safety mechanisms which help prevent collisions during unit movements:

- ❏ Dead man's grip (**DMG**)
  Movements take place only as long as the operating element is actuated.
- ❏ Collision computer
  A computer constantly calculates all possible collisions between the stand(s)/ C-arm(s) and the patient table.
- ❏ Speed reduction
  The speed is automatically reduced for movements in the collision area or in particular system positions and movement is stopped, if necessary.
- ❏ Collision sensors / infrared sensors[1]
  In case of a collision, sensors, e.g. on the FD, automatically stop the movement.
- ❏ Collision protection bar on the footswitch[1]
- ❏ Emergency STOP buttons
  Movements are stopped immediately when an emergency STOP buttons is being pressed.

⇨ Part **Safety (Volume 1**

When movements are blocked, a message appears on the data display.

If a C-arm is moved into the collision zone with the other C-arm (biplane) or with the patient table, a warning sound (configurable) is emitted and the movement is slowed down.

Please note that the movement is not stopped, i.e. collisions can occur!

The safety equipment of the system does not release you as the user from your obligation to pay attention to the patient and the system during unit movements!

In biplane systems, when one stand is moved, the other stand *gets out of the way (deviation movement)* to avoid blocking the movement.

[1] Artis dMP only

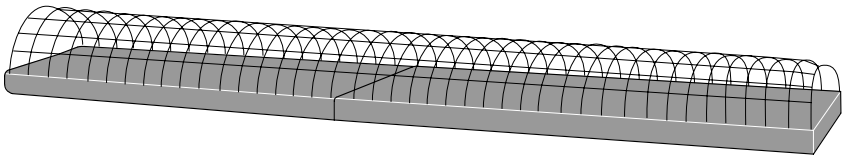
Collision computer

To keep the probability of a collision to a minimum, a collision computer continuously monitors the positions of all integrated components of the system with respect to one another and the room. The collision computer detects when defined distances are violated. In such a case, it reduces the movement speed and triggers an audible alarm.

Monitored area

The collision computer monitors the patient table, stand(s), floor, walls, and ceiling/ceiling rails as well as a calculated envelope around the patient.

The envelope around the patient can only be deactivated by Siemens Service. In that case, the collision computer will not take account of the patient!



Example of a calculated collision area around the patient

Please note, that the following areas/components are *not* monitored by the collision computer:

- ❏ The actual area in which the patient is positioned (e.g. projecting extremities).
- ❏ Monitor suspension system
- ❏ Trolley for control modules
- ❏ Corrugated hoses
- ❏ Movable accessory rails
- ❏ Attachments and accessories such as
  - – Armrests, arm supports
  - – Radiation protection
  - – Examiner light

- ❏ Mobile equipment such as
  - – Control consoles
  - – Footswitch
  - – Contrast medium injector
  - – IV bottle holder
  - – Instrument trays
  - – Pieces of furniture, e.g. chairs
- ❏ Parts of the system equipped with mechanical collision sensors such as
  - – Flat detector
  - – Primary collimator
  - – Outer edges of the C-arm
  - – Patient table[1]

Stopping movements

All motorized movements stop when:

1. the operating element is released,
2. an end position is reached,
3. a basic position is reached (can be configured by Siemens Service),
4. a collision sensor/infrared sensor[1] responds,
5. the collision computer reduces the speed until stop,
6. an emergency STOP button is pressed.

In certain situations, the speed of unit movements is reduced for safety reasons.

⇨ Also see "Safety equipment" on page 15.

[1] Artis dMP only

Resuming the movement

Depending on why the movement was stopped, different measures can be taken to resume the movement:

Case 1. If you have released the operating element unintentionally:

- ◆ You can resume the movement at any time by operating the operating element again.

Case 2. If an end position has been reached:

- ◆ You can only initiate movement in the opposite direction by tilting the operating element in a different direction.

Case 3. If stopping at a basic position has been programmed:

- ◆ You can resume the movement by releasing the operating element and operating it again.

Resuming movement after collision (override)

Case 4. If a collision occurred and the collision sensor/infrared sensor[1] responded:

- ◆ You can initiate a movement by pressing buttons **I** and **II** simultaneously and operating the operating element in a different direction.
  – The message "Movement: Safety override" appears on the data display

Caution

Safety override active

Higher risk of collision.
Risk of mechanical or personal damage.

- ◆ Execute unit movements with great care when safety override is active.

- ◆ Tilt the operating element in one of the possible directions.

⇨ Also see Part **Troubleshooting**, Chapter **System Messages / Troubleshooting**, "No unit movement possible"

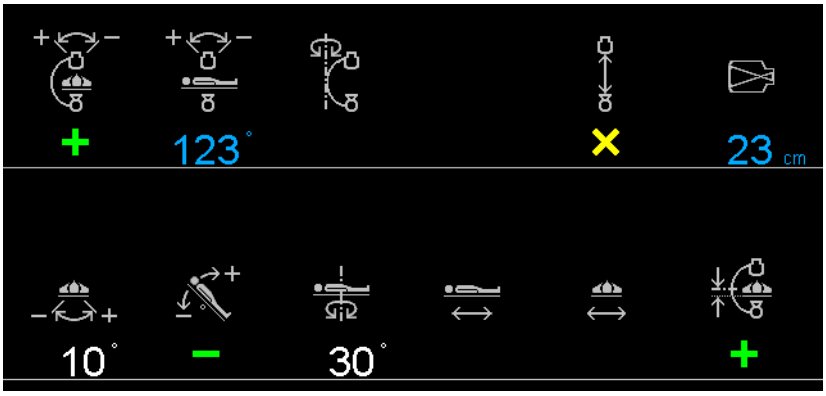
[1] Artis dMP only

Displays

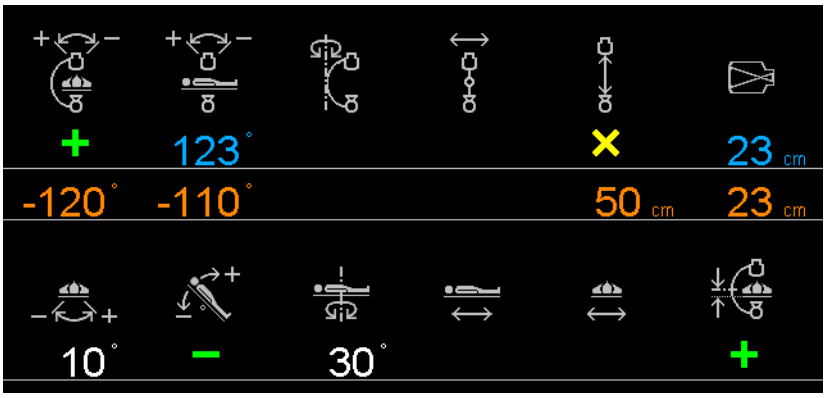
The possible directions are indicated on the data display with **+** and **-**.

Directions which are not possible are marked with **x**.

⇨ Also see Part **System Overview / Operating Elements**, Chapter **Operating Elements and Displays in the Examination Room**, "Readings on the data display"

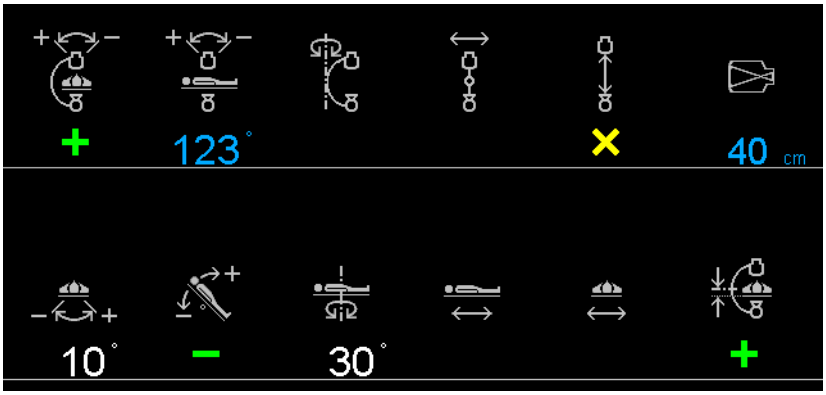


Display example single plane Artis dFC/dFA



Display example biplane Artis dBC/dBA

Display example Artis dMP



Display example Artis dTC/dTA

Case 5. If the movement has been slowed down by the collision computer, it can be resumed until the unit stops.

In rare cases, e.g. when the patient table is tilted, it is not possible to resume the movement:

- Proceed as described under “Case 4.”.

Case 6. If an emergency STOP button has been operated:

- You can resume the movement by operating the operating element again after you have rectified the cause and unlocked the emergency STOP button.

⇨ Part **Safety (Volume 1)**

Operating locations and priorities

AXIOM Artis systems can be equipped with more than one control console, e.g. for operation in the examination room at the patient table, on the trolley, or in the control room.

There are also additional keys on the flat detector.

Priorities

The following rules apply:

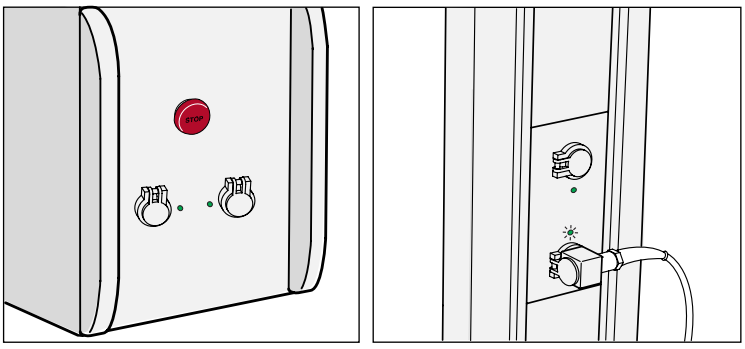
- ❏ System operator actions are structured in *function groups*, e.g.:
  - – Stand control module (SCM)
  - – Table control module (TCM)
  - – Collimator control module (CCM)
- ❏ Operation of an operating module in the examination room disables the function of the associated function group in the control room or at the trolley.
- ❏ There are two priorities for operating elements:
  - – higher priority: Control modules
  - – lower priority: Membrane keys on the flat detector.

Examples:

- – Operation of a membrane key on the iflat detector can be interrupted by operation at the stand control module.
- – Operation at a table control module cannot be interrupted by operation at the flat detector.

Connecting the control consoles (Artis dMP only)

Both the support arm of the tabletop of the Artis dMP stand and the support column of the trolley for the control consoles have two sockets each for control consoles.



If socket covers are damaged, e.g. if a cover cap has broken off, it is no longer safe to touch the sockets.

◆ Contact Siemens Service and have the defective sockets replaced.

Display LEDs

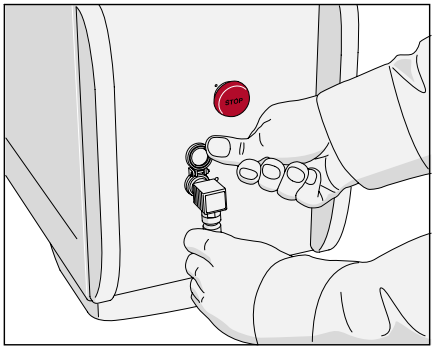
Between the two sockets on the termination panel, there are two display LEDs, each assigned to a socket. Each of these two LEDs has two illumination states: red and green.

❏ Green means: Control console ready, emergency STOP circuit ready.

❏ Red means: Control console possibly ready, emergency STOP circuit is *not* ready. There is a malfunction that can only be remedied by a service technician.

Connecting a control console

You can plug in or remove control consoles even during operation.



◆ Open the covering cap of the socket.

◆ Insert the connector into the socket as far as it will go; pay attention to the direction (cable downward on the supporting arm of the horizontal tabletop, cable to the right on the supporting column of the trolley for the control consoles).

◆ Close the cover cap slowly.
– The LED display next to the socket lights up green.

Positioning the control consoles

Control consoles can be hooked into the accessory rails of the patient table or into the rails of the control console trolley.

Control consoles should always remain attached at the intended points when they are operated.

Positioning a control console

- Remove the control console from the rail by lifting it tilted slightly backward.
- Hook it in again at the required position.

Setting the orientation

The "LAO/RAO" and "cranial/caudal" directions apply only if

- ❏ the control consoles are in the *default position* (on the right of the patient in the default position **Head First - Supine**) *and*
- ❏ the correct LED in the orientation key lights up.

⇨ Part **System Overview / Operating Elements**, Chapter **Operating Elements and Displays in the Examination Room**, "Orientation key"

- Check whether the orientation of the control console matches the current position.

If necessary, you can change the orientation of the control console (and therefore the directions of movement)

- Press the orientation key (repeatedly if necessary) and hold it pressed for longer than 3 seconds.

Table movements

Raising / lowering the table

- Press the key for the required movement and keep it pressed until the required table height is reached.
  – The table height is changed immediately.

The speed of the upward table movement depends on the pressure exerted on the key:

- ❏ light pressure: low speed
- ❏ strong pressure: high speed

> *In the case of Artis dMP systems, downward table movements can result in a collision with the C-arm. In that case, the movement stops.*
>
> *If you press the key again, the table will no longer move downward, but (depending on configuration) the stand will move downward!*

Stopping in the isocenter

ISO stop

You can program the table to stop automatically when the isocenter is reached.

- Set the table height for the isocenter.

- Press the **Isocenter** key.
  – The LED lights up.
  – The current table height is saved as isocenter height.
  – The table stops every time this position is reached.
  – The displays of the table coordinates **X-Position**, **Y-Position**, and **IO-Height** are set to zero and show the *relative* coordinates (relative to the patient with reference to the patient position) as long as the LED is lit.

No stop

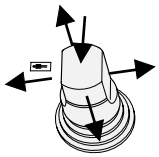
- Press the **Isocenter** key again.
  – The LED goes out.
  – The table moves continuously through the isocenter.
  – The displays of the table coordinates **X-Position**, **Y-Position**, and **IO-Height** indicate *absolute* (table) coordinates again.

The ISO stop function is automatically deactivated when a new patient is registered.

Moving the tabletop

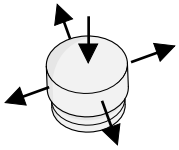
Artis dMP

Motorized operation of the tabletop is possible using the table joystick:



- Press the table joystick down and tilt it sideways.
  – The tabletop follows the movement.

With an additional table control module for operating the patient table, it is possible to move the tabletop in "floating" operation with servo support.



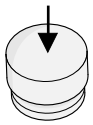
- Press the panning knob down and hold it down.
  – The tabletop follows the movement.

Other systems

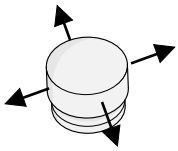
The movement of the tabletop can be configured by Siemens service in two ways:

Switchover function

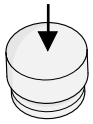
The brakes are released and applied again:



- Press the panning knob once.
  – The brakes are released.
  – The tabletop can be moved freely.



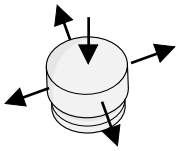
- Position the floating tabletop.



- Press the panning knob a second time.
  – The brakes are applied again.
  – The tabletop is locked in position.

Continuous holding

The brakes are released only if the panning knob is pressed:



- Press the panning knob down and hold it down.
  – The brakes are released.
  – The tabletop can be moved freely.

To apply the brakes:

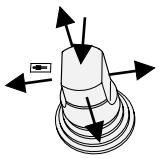
- Release the panning knob.

Depending on the patient table version, the floating tabletop can either be moved only manually or in a motor-assisted manner (servo).

The Fluoro pedal of the footswitch can also be configured by Siemens Service to release the tabletop brakes (dual function).

Moving the tabletop (additional control console)

For a patient table with tilt, the control console can be installed separately from the patient table (e.g. if mounted on the trolley for control modules). In that case, "floating" operation of the tabletop is not possible. Instead, the tabletop is motor-controlled by means of the table joystick:



- Press the table joystick down and tilt it sideways.
  – The tabletop follows the movement.

Moving the tabletop longitudinally only

For some examinations, e.g. peripheral angiography, it is necessary to block transverse table movement.

- Press the key for disabling lateral movement of the tabletop.
  – The LED lights up.
  – The tabletop can only be moved longitudinally when the brakes are released.

To enable tabletop movement in any direction once again:

- Press the key again.
  – The LED goes out.
  – The tabletop can be moved freely in the longitudinal and transverse directions.

Tilting the table

Artis dMP The patient table can be tilted by ±90° with the system.

Other systems **Longitudinal tilt (transverse axis)**

If a tilting patient table is installed, the tabletop with the patient can be tilted by ±15° to the head-up position (reverse Trendelenburg) or head-down position (Trendelenburg).

When the table is tilted to the Trendelenburg or reverse Trendelenburg position, motorized movement of the tabletop in the longitudinal direction and "floating" movement in the transverse direction are possible.

Lateral tilt (longitudinal axis)

If the table with lateral tilt is installed, the tabletop with the patient can be tilted sideways by another ± 15°.

When the table is tilted laterally, the tabletop can only be moved in the longitudinal direction.

- Check the tabletop position before tilting the table.

Speed

The speed of the table tilt movement depends on the pressure exerted on the key:

❏ light pressure: low speed

❏ strong pressure: high speed

Activating lateral tilt[1]

If you want to tilt the table laterally, you must activate this tilt type.

◆ If necessary, press the key for lateral tilt.
– The LED lights up.

Tilting the tabletop

Caution

Patient table tilted

Danger of patient sliding off

◆ Secure the patient on the tabletop before tilting it.

◆ Artis dMP: Use the shoulder belt and/or foot holder to secure the patient.

◆ Press the key for the required movement and keep it pressed until the required table tilt is reached.
– The table tilts in Trendelenburg or reverse Trendelenburg direction.
– The tabletop tilts sideways if lateral tilt is activated.[1]

Position the tabletop horizontally

◆ Press *both* keys simultaneously and hold them pressed until the movement stops automatically.
– The tabletop is horizontal.

Or[2]

◆ Press and hold the **zero stop** button.

[1] only in systems with separate patient table
[2] Artis dMP only

Moving the table to the basic position

The basic position of the patient table is defined as:

- ❏ Tabletop horizontal
  - – Lateral tilt 0°
  - – Trendelenburg tilt 0°
- ❏ Tabletop in center position
- ❏ Table height is such that the patient is in the isocenter

HOME

- ◆ Press the **Home** key on the handheld remote control and keep it pressed.
  - – The tabletop is swiveled back into the horizontal position.
  - – The table height is adjusted to zero position (isocenter).

You can move the table to the basic position with the **Home** *key even if there is a power failure. (Emergency power supply)*

C-arm movements (angulations)

The C-arm is used to set the projection angle. Angulations are performed in the cranial/caudal and LAO/RAO directions[1].

Speed The speed of the movements depends on how far you tilt the joystick: maximum speed with maximum tilt.

During angulations, organs which are located in the isocenter remain there, that is, at the same place on the monitor.

The direction of the movement depends on the orientation of the control module. Please take into account the orientation of the control module.
Take care to avoid possible collisions.

[1] The directions are always in relation to the patient.

Artis dMP

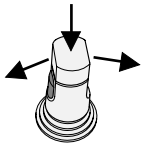
C-arm orbital movements (LAO/RAO angulations)

◆ Press the **C-arm joystick** down and tilt it forward or backward.

The C-arm performs the corresponding LAO/RAO angulation.

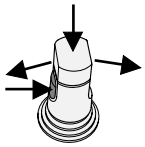
C-arm rotation (cranial/caudal angulations)

Depending on the configuration set by Siemens Service, the C-arm can be angulated cran/caud *without* (default) or *with* pressing the side button.



◆ Press the **C-arm joystick** down and tilt it to the left or right. (Standard control module orientation)

Or (depending on the configuration)

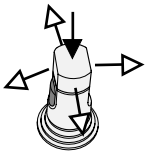


◆ Press one or both side buttons on the **C-arm joystick**, press the joystick down and tilt it to the left or right.

The C-arm performs the corresponding cran/caud angulation.

Other systems

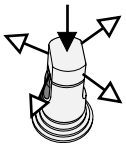
C-arm rotation/orbital movement (cranial/caudal/LAO/RAO angulations)



◆ Press the **stand joystick** (of the correct plane) down and tilt it in the required direction.
– The C-arm performs the corresponding angulation.

Combined C-arm movements

Combined C-arm movements are possible when the joystick is tilted diagonally (e.g. 45°).



◆ Press the **stand/C-arm joystick** (of the correct plane) down and tilt it diagonally.
– The C-arm performs the corresponding movement.

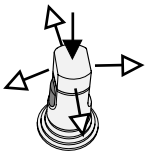
ISO tilting

If the patient table with motorized longitudinal table movement and reverse Trendelenburg / Trendelenburg table tilt is installed, Siemens Service can configure *ISO tilting*.

If this is the case, the patient angle is maintained when the **Isocenter** key is activated, that is, during angulation of the C-arm, the patient table performs the corresponding compensating movement (table tilt, table height, and table longitudinal movement) so that the organ under examination remains in the isocenter (position and angulation).

- Press the **Isocenter** key on the table control module.
  – The LED lights up.

⇨ Also see "Stopping in the isocenter" on page 24



- Press the **stand joystick** down and tilt it in the required direction.
  – The patient table follows the angulation.

No ISO tilting

- Press the **Isocenter** key again.
  – The LED goes out.

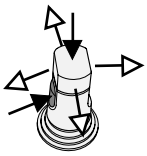
The ISO function is automatically deactivated on registration of a new patient.

Simultaneous movements of both C-arms (Artis dBC/dBA)

In certain positions of the stands it is possible to angulate both C-arms *simultaneously* so that the relative position (angle) of the C-arms in relation to one another does not change. (Only simultaneous LAO/RAO angulations are possible).

Take care to avoid possible collisions.

Simultaneous angulation

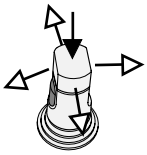


- Press one of the two keys on the side of the **stand joystick** (of plane B), press the joystick down and tilt it in the required direction.
  – Both C-arms move simultaneously.

Or

Switch over to simultaneous angulation

- Press the key for biplane simultaneous angulation on the control module of plane B.
  – The LED lights up.
  – A message appears on the data display.



- Press the **stand joystick** (of plane B) down and tilt it in the required direction.
  – Both C-arms move simultaneously.

Single angulation

To cancel synchronous movement:

- Press the key once again.
  – The LED goes out.
  – The message on the data display disappears.

Overtable/undertable conversion

Caution

Undertable operation of the flat detector

Danger of liquid penetrating into the unit

- Always cover the units to protect them from liquids.

Artis dMP

The flat detector is normally positioned above the patient table. The system must execute a number of movements to position the FD under the patient table.

Sequence of movements:

1. The patient tabletop is raised and moved to its basic position.
2. The patient tabletop swivels into the 0° position.
3. The maximum source to FD distance is set.
4. The patient tabletop moves to the maximum foot-end position and the C-arm moves to the maximum head-end position.
5. The C-arm is centered in relation to the patient table.
6. The tabletop moves in the transverse direction into the center position.
7. The orbital drive moves to 90° RAO.
8. Now the C-arm is rotated.
9. The system returns to the stored C-arm longitudinal position.

The conversion is completed.

Performing the conversion

The **overtable**/**undertable** positions are stored as system program.

- Select the required position.

⇨ “Moving to system and programmed positions” on page 40.

Pay attention to the messages on the data display.

- Tilt the C-arm joystick backward until the target position is reached.

⇨ Also see “Moving to the target position” on page 42.

Artis dTC/dTA

You can easily move the flat detector from its position above the patient table to a position under the patient table.

- Move the stand longitudinally to a position outside the patient table.

⇨ "Stand/C-arm longitudinal movements (top stand or Artis dMP)" on page 35

- Draw in the tabletop (footward), if necessary.

⇨ "Moving the tabletop" on page 25

- Rotate the C-arm about its transverse axis.

⇨ "C-arm movements (angulations)" on page 29

Stand/C-arm/system movements

Stand/C-arm longitudinal movements (top stand or Artis dMP)

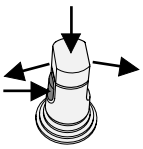
The C-arm can be positioned in the patient longitudinal axis:

- ❏ Artis dBC/dBA top stand/C-arm
- ❏ Artis dTC/dTA top stand/C-arm
- ❏ Artis dMP C-arm

Speed The speed of the movements depends on how far you tilt the joystick: maximum speed with maximum tilt.

Positioning the C-arm longitudinally

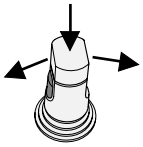
Take care to avoid possible collisions.



- ◆ Press one or both side buttons on the **stand/C-arm joystick**, press the joystick down, and tilt it to the left or right.

Or

Depending on the configuration set by Siemens Service, the C-arm can be positioned *with* (default) or *without* pressing the side button.[1]



- ◆ Press the **C-arm joystick** down and tilt it to the left or right.

The C-arm moves to the left or right accordingly.

The movement stops automatically when the left or right end positions are reached.

In Artis dMP however, if you continue to tilt the joystick, the movement is performed in the reverse direction at the same speed!

[1] Artis dMP only

System lift (Artis dMP only)

The system is normally configured in such a way that the isocenter remains constant during system lift:

❏ The height of the stand and the height of the patient table are simultaneously changed in the same direction.

Alternatively it can be configured in such a way that the table height remains constant during system lift:

❏ The height of the entire stand including the patient table is altered to keep the table height constant. To do so, the table is lowered with respect to the C-arm by the same distance that the system is raised. The table seems to remain stationary.

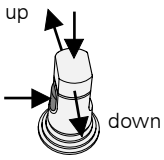
With a table tilt greater than ±30° the movements automatically merge. This also applies when the C-arm threatens to hit the floor or the ceiling.

◆ Release the operating element and operate it again.

Speed The speed of the movements depends on how far you tilt the joystick: maximum speed with maximum tilt.

Performing the lift

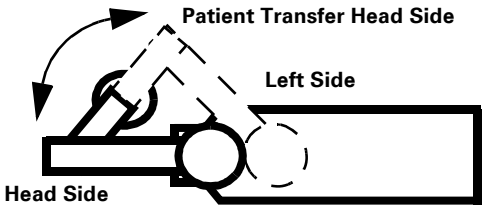
Take care to avoid possible collisions.



◆ Press one of the two buttons on the side of the C-arm joystick, press the joystick down and tilt it backward or forward.
– The system height is increased or reduced.

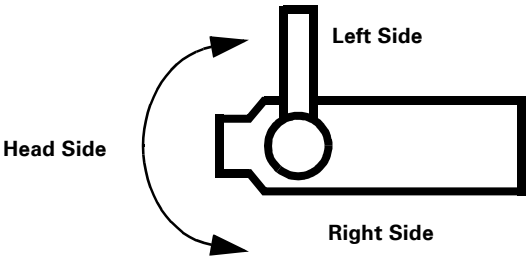
Stand swivel (floor stand or Artis dTC/dTA top stand)

Floor stand The floor stand can be swiveled between specific positions, e.g. between **Head Side**, **Patient Transfer Head Side**, and **Left/Right Side**.



Floor stand swivel positions

Top stand The Artis dTC/dTA top stand can be swiveled about the patient table.



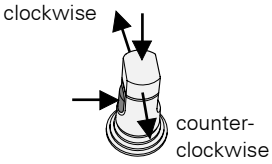
Top stand swivel positions

Speed The speed of the movements depends on how far you tilt the joystick: maximum speed with maximum tilt.

Angulation Siemens Service can configure the stand swivel movement in such a way that the angulation of the C-arm in relation to the patient is not changed, i.e. the C-arm executes a compensating movement when the stand is swiveled. The patient angle remains constant.

Swiveling the stand

Take care to avoid possible collisions.



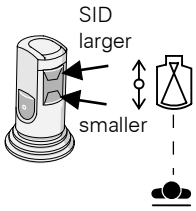
- Press one or both buttons on the side of the corresponding **stand joystick**, press the joystick down and tilt it backward or forward.
  - The stand swivels clockwise or counterclockwise.
  - The C-arm remains in the same position in relation to the patient if the **Isocenter** key has been activated.
  - The stand automatically stops in the basic positions.

FD lift / Setting the SID

The image receptors are mounted on slides so that the distance from the X-ray source to the image receptor plane (SID) can be changed.

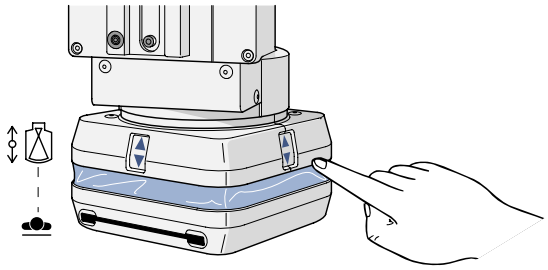
Take care to avoid possible collisions.

When the SID is changed, collimation is automatically readjusted.



- Press the **rocker switch** on the back of the **stand/C-arm joystick** (of the correct plane).
  - Upper switch: increase SID
  - Lower switch: decrease SID

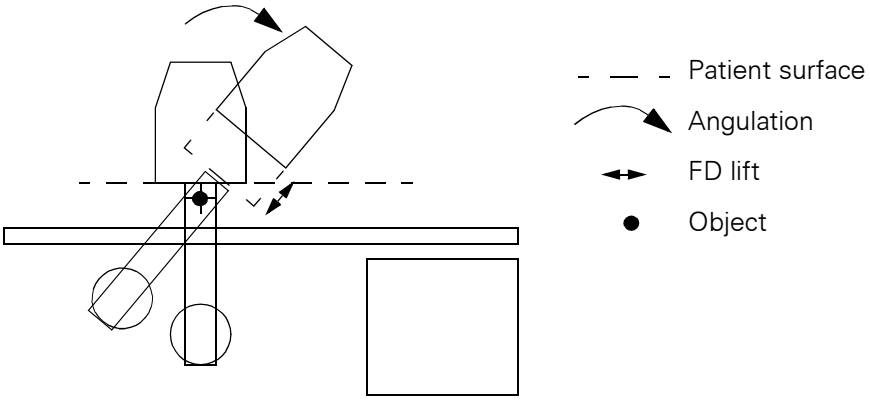
Or



- Press the membrane key on the flat detector.

Automatic adjustment of the FD-object distance

The following function can be configured for Artis dMP by Siemens Service:



During a C-arm rotation (cran/caud angulation), the object to image receptor distance is automatically adjusted. The distance between the table surface and the lower edge of the FD remains constant.

This function is switched off if the FD has reached the end position or the collision protection is activated. It is also switched off if the distance between the table surface and the lower edge of the FD is greater than 40 cm.

This function is inactive while you change the SID or perform an orbital movement. After that, the function is activated again once a new SID has been set.

Automatic adjustment of the object to image distance also functions when the FD is in the undertable position (with reduced speed only).

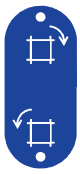
Rotating the FD / Setting portrait/landscape

The 30x38 flat detector has an edgewise image format. The FD and also the collimator[1] can be rotated by 90 degrees for best view of the region of interest.

Changing from portrait to landscape or vice versa

◆ Press this key on the FD.

Or (only if no manual image rotation is active):



◆ Press one these keys on the collimator control module shortly.

[1] not in Artis dMP

When the FD is rotated, collimation is automatically readjusted.

The image on the monitor is changed accordingly so that the image always has the standard orientation regardless of the FD rotation.

Moving to system and programmed positions

Targets First select the position type with the keys on the stand control module (SCM):

❑ **System positions**
Some basic positions such as **Cardio Pulmonary Resuscitation** (CPR) and **Patient Transfer Head Side** are saved as special *system positions*.

⇨ Please observe the information on CPR in part **Safety (Volume 1)**

With system positions, the first position is always set as the default position.

You should use this position for cardio pulmonary resuscitation.

❑ **Programmed positions**
You can save a number of positions that you require for examinations as *programmed positions*.

With programmed positions, the first program is preset via the first selection, the second program is preset via the second selection, etc.

If system positions are arranged in the order in which they are needed during the examination, they can be selected one after the other as required.

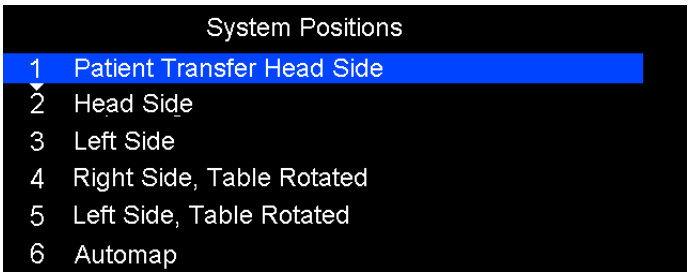
Procedure Programmed stand, C-arm, and table movements are initiated as follows:

1. Select system or programmed position
2. Confirm target position
3. Move to target position

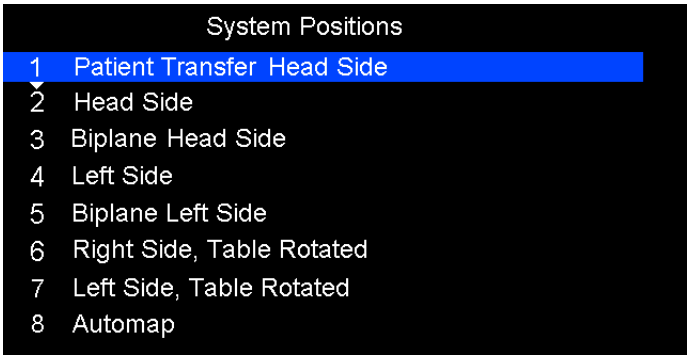
Selecting the target position

- Press the required key.
  – The LED on the key lights up.

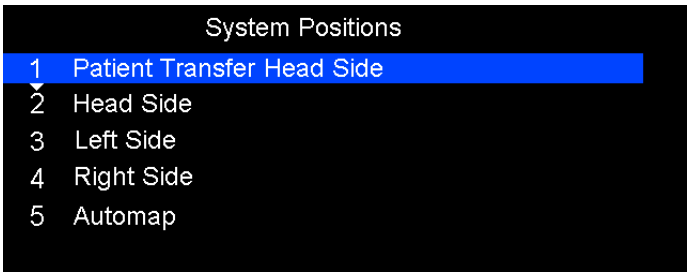
The corresponding menu appears on the data display.



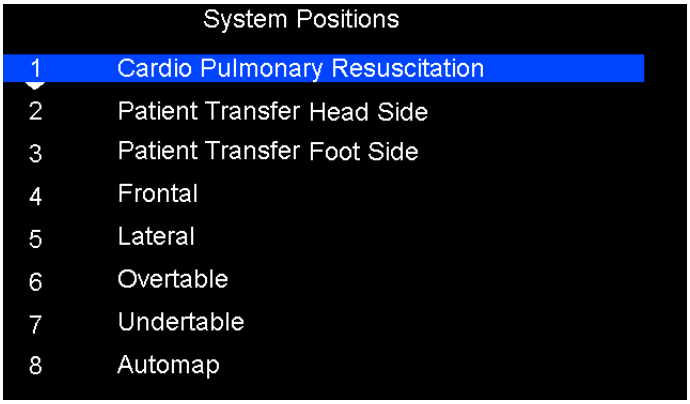
Example Artis dFC/dFA



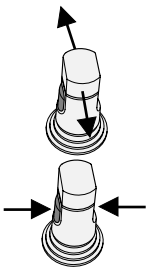
Example Artis dBC/dBA



Example Artis dTC/dTA



Example Artis dMP



- Select the required target by tilting the **stand/C-arm joystick** (of plane A).

- Confirm the required target by pressing one (or both) side buttons.

Moving to the target position

Take care to avoid possible collisions.

- Press the **stand/C-arm joystick** down and tilt it to the back until the target position has been reached.

Or, if hands free movement is configured:

- Press the pedal on the footswitch.
  – The system performs the required movements.
  – When the target position is reached, the LED on the program key goes out.
  – The system returns to its original state.

Notes on the sequence of movements

❏ The speed of the movements depends on how far you tilt the joystick: maximum speed with maximum tilt.

❏ Several necessary movements (stand, C-arm, table) are performed *simultaneously* if this is possible without any danger.

❏ If you release the joystick or tilt it in a different direction, *all* unit movements are stopped. The programmed movement is stopped.

❏ If a collision protection device (collision sensor) responds during unit movements, *all* movements are stopped immediately and can be resumed only when the cause has been remedied.

Information about the movement sequence is shown on the data display.

◆ Please pay attention to the information on the data display.

Stopping a programmed movement

You can stop a movement at any time by:

◆ Releasing the joystick

◆ Pressing the program key.
– The LED on the program key goes out.
– The system returns to its original state.

Automatic cancellation

❏ If the joystick is not operated within a certain time (configurable by Siemens Service, default 30 s) after selecting the System or Programmed Positions, the system automatically returns to its original state.

❏ If the movement is interrupted and the joystick is no longer operated within a certain time (configurable by Siemens Service, default 5 min), the system will also return to the zero state.

The LED on the program key goes out.

Moving to system positions using shortcut keys (direct positions I, II, III)

Movement to the three most frequently used system positions can be initiated with the direct positions I, II, and III:

Take care to avoid possible collisions.

- ◆ Press the required position key.
  – The LED on the program key lights up.

⇨ Continue as described from "Moving to the target position" on page 42 onward.

Automap

The **Automap** feature allows you to restore the acquisition position of an existing reference image or to display the reference image of the current system position.

Requirements

Automap is executed only if:

- ❑ the reference image was acquired with the same or a similar acquisition system (the same AXIOM Artis C-arm system and patient table)
- ❑ the current patient position is identical with the stored patient position.

Automap is not possible for images of other Siemens systems, other manufacturers or other modalities such as CT/MR).
Automap is not possible when a reference image of plane B from a biplane system is selected on a single plane system.

Automap cannot be selected if the current acquisition program is a PERIVISION, PERISTEPPING, DYNAVISION or DR-DYNAVISION program.

With biplane systems the Automap function restores the system positions of *both* planes, regardless of the acquisition plane of the reference image.

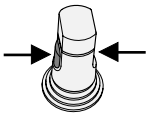
Moving to the system position of the reference image

- Select the required reference image.

⇨ Part **Image Viewing and Image Processing**, Chapter **Managing and Viewing Scenes/Images**.

- Press the **System Positions** key.
  – The LED on the program key lights up.
  – The corresponding menu appears on the data display.

- Select the **Automap** position by tilting the **stand/C-arm joystick** (of plane A) backward/forward.



- Confirm the position by pressing one or both buttons on the side of the **stand/C-arm joystick** (of plane A).

⇨ Continue as described from “Moving to the target position” on page 42 onward.

Displaying the reference image for the current system position

- Activate **Automap** on the touchscreen control.
  – The matching reference image is displayed.
  – If there is no reference image matching the current system position, a message will appear.

Storing programmed positions

You can store any system positions. Then you can initiate programmed movements to stored system positions.

⇨ "Moving to system and programmed positions" on page 40.

What is stored?

All data important for imaging geometry are stored:

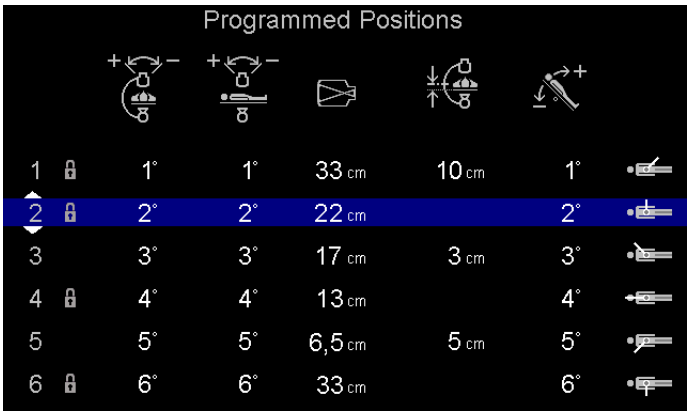
- ❏ Stand and C-arm position
- ❏ Table height (configurable by Siemens Service)
- ❏ SID, zoom stage, collimation and filter positions

⇨ Also see Part **System Operation**, Chapter **Image Format, Collimation and Filtration**, "Storing filter positions or deleting them"

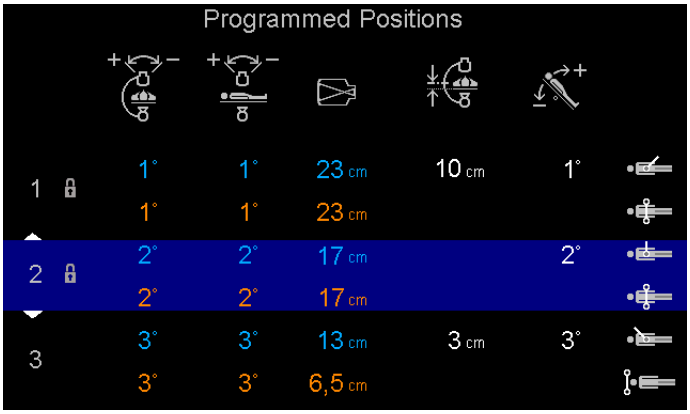
Storing a position

- ◆ Move the unit to the required position.
- ◆ Set the primary collimator and the filter diaphragms.

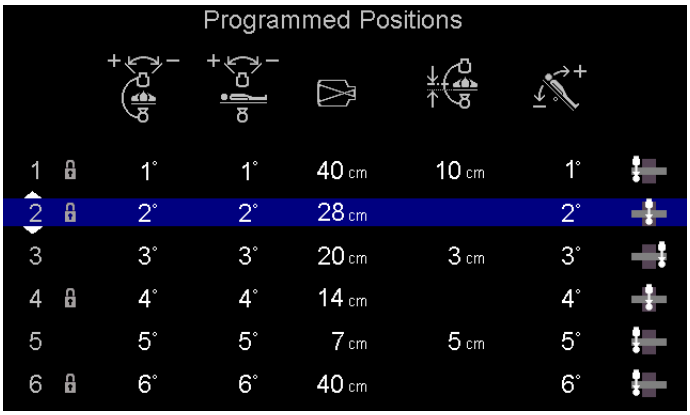
- ◆ Press the **Store** key.
  - – The LED on the key lights up.
  - – The **Programmed Positions** menu appears on the data display.
  - – The first free position is selected.



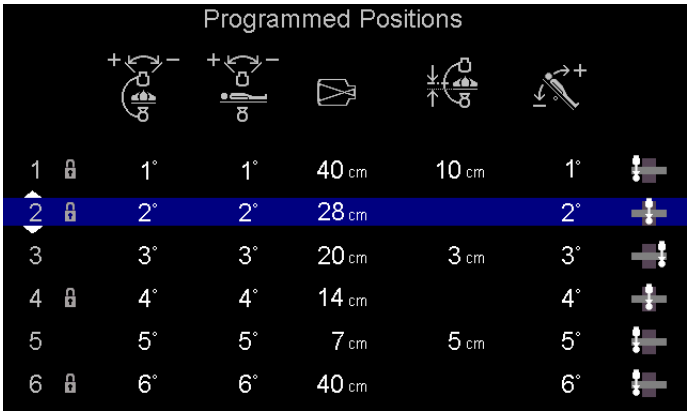
Example Artis dFC/dFA (schematic without clinical meaning)



Example Artis dBC/dBA (schematic without clinical meaning)

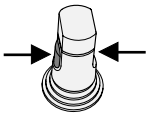


Example Artis dTC/dTA (schematic without clinical meaning)



Example Artis dMP (schematic without clinical meaning)

- Select the required memory position (number) by tilting the **stand/C-arm joystick** (of plane A) backward/forward.



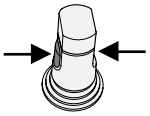
- Press one or both buttons on the side of the **stand/C-arm joystick** (of plane A).
  – The current system position is stored under the selected program number.
  – The LED on the **Store** key goes out.
  – The system returns to its original state.

Overwriting a position

Programmed positions can be protected against deletion or overwriting by Siemens Service.

Such positions are marked with a lock symbol.

If you wish to overwrite the memory position:



- Press one or both buttons on the side of the **stand/C-arm joystick** (of plane A).
  – The current system position is stored under the selected program number. (The previous position is deleted.)
  – The LED on the **Store** key goes out.

Otherwise:

- Select a different position by tilting the **stand/C-arm joystick** backward/forward.

Canceling the process

- Press the **Store** key or the **System Positions** key.
  – The LED on the **Store** key goes out.
  – The system returns to its original state.

Automatic cancellation

If the joystick is not operated within *30 seconds* after selecting the **Store** key, the system automatically returns to its original state.
  – The LED on the **Store** key goes out.

Storing system positions with shortcut (direct positions I, II, III)

You can assign the three most frequently used system positions to the direct positions I, II, III:

◆ Move the unit to the required position.

◆ Press the **Store** key.
– The LED on the key lights up.

◆ Press the required position key.
– The current system position is stored under the selected direct position number. The previously stored position is deleted.
– The LED on the **Store** key goes out.
– The system returns to its original state.

Cancellation ⇨ See above.

Deleting programmed positions

You can also delete the stored system positions.

Positions marked with a lock symbol can only be deleted by Siemens Service.

◆ Press the **Programmed Positions** key.
– The LED on the key lights up.
– The **Programmed Positions** menu appears on the data display.

◆ Select the memory position (number) you want to delete by tilting the **stand/C-arm joystick** (of plane A) backward/forward.

◆ Press the **Store** key for longer than 2 seconds.
– The memory position is deleted.
– The LED on the **Store** key goes out.

Manual stand movements

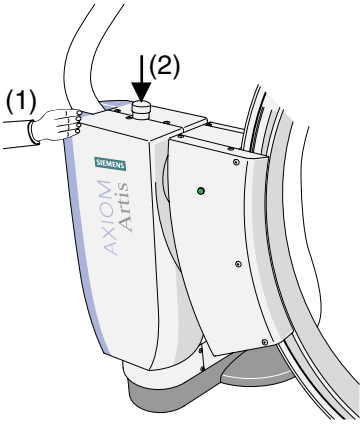
If a power failure occurs, the Artis dFC/dFA and Artis dBC/dBA stands can be moved manually by applying sufficient force.

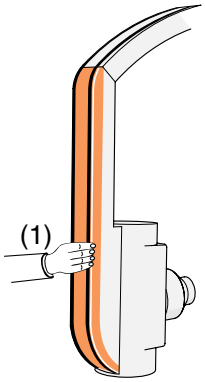
❏ The Artis dFC/dFA floor stand can be swiveled by pushing against the column.

❏ The Artis dBC/dBA top stand can be moved to the required position by pushing the C-arm.

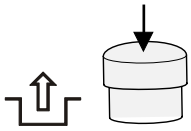
The Artis dTC/dTA top stand cannot be moved manually.

The Artis dMP stand cannot be moved manually.





Floor stand



◆ First unlock the floor stand by pressing the unlocking button (2).

Floor stand and top stand

◆ Hold the stand at the location marked (1) to move it manually.

Movement to or from a position with swiveled table (Multispace F only)

To perform movements from one position to another, you may have to move the floor stand and the patient table manually into another swivel position.

This applies especially when changing the position from **Patient Transfer Head Side**/**Head Side**/**Left Side** to **Right Side, Table Rotated** / **Left Side, Table Rotated**.

⇨ "Positions of the floor stand (Artis dFC/dFA and Artis dBC/dBA)" on page 11

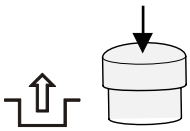
Selecting the target position

- Select the required target position.

⇨ "Selecting the target position" on page 41.

Swiveling the floor stand manually

Pay attention to the messages on the data display.



- Unlock the floor stand by pressing the unlocking button.

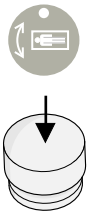
⇨ "Manual stand movements" on page 50

- Swivel the stand to the required position and move it back and forth slightly until it engages.

Swiveling the table manually[1]

Pay attention to the messages on the data display.

Electromechanical unlocking



- Press the **table swivel** key on the table control module.
  – The LED on the key goes out
- Press the **panning knob** down and hold it down.
  – The brakes for table swivel are released.
- Swivel the patient table.
- Release the table panning knob.
  – The brakes for table swivel are locked.

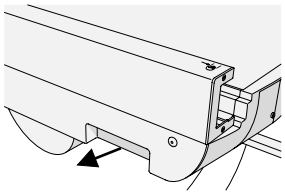
Manual unlocking (e.g. when power failed)

Caution

Pulling both grips at the same time

Danger of crushing

- Only ever pull one grip at a time.



- Pull out *one* of the two grips at the foot end of the patient table and hold it in that position.
- Swivel the patient table.
- Release the grip.
- Swivel the patient table back and forth slightly until you hear it engage.

While swiveling the table back to the zero position, remember that collisions between the table and the unit can occur if, after swiveling the table out of the zero position, the tabletop was moved toward the head end or
the C-arm was moved toward the table.
No collision message is shown on the data display in these cases!

[1] not in Artis dMP

Moving to the target position

- Press the **stand joystick** down and deflect it to the back until the target position has been reached.

⇨ "Moving to the target position" on page 42.

Swinglab operation

In systems equipped with two patient tables you can change the stand (and curtain) position from patient table 1 (room 1) to patient table 2 (room 2) or vice versa.

Intended use

The swinglab feature helps you to optimize the patient throughput.

During one patient is examined in one room, another patient can be prepared or finished in the other room.

Changing position from room 1 to room 2

After you have finished an examination on table 1, you can change the position of the stand to position 2.

✓ Curtain 1 is closed and curtain 2 is open.

- Move table 1 and stand to **Patient Transfer Head Side**.

⇨ "Moving to system and programmed positions" on page 40

- Open curtain 1.

Opening the curtain activates the emergency STOP circuitry which causes all motorized movements (and radiation) to be disabled until the curtain 1 or curtain 2 is closed again.

- Rotate the floor stand manually from **Patient Transfer Head Side** at table 1 to **Patient Transfer Head Side** at table 2.

⇨ "Manual stand movements" on page 50

- Close curtain 2.

Caution

Curtain not closed (with swinglab only)

Risk of blocked radiation

- Always close the curtain *before* releasing radiation.

Caution

The **Home** function (e.g. pressing both tilt keys at the same time) is not supported on the inactive table in a swinglab.

Risk that the tabletop cannot be pulled back for CPR.

- Drive the table tilt of the inactive table in a swinglab configuration to zero degrees (0°) by the corresponding tilt key. (The 0° position is indicated by the orientation key.)

Closing curtain 2 causes the system to switch from room 1 to room 2.

❏ Movements in room 2 are fully enabled.

❏ Movements of the patient table in room 1 are possible.
All other (e.g. stand) movements are blocked.

- Perform your examination in room 2.
- Perform patient transfer and prepare the patient in room 1.

Differences of table movement between active and inactive room:

❏ Tilt- and cradle-**Home** are not supported in the inactive room.

❏ The table moves in the intended direction but does not stop at the 0° position.

❏ The LEDs at the orientation key indicate if the table is aligned to 0°:
– The LEDs at foot- and head-end side are “on” indicate that longitudinal tilt is aligned.
– The LEDs at left- and right-end side are “on” indicate that lateral tilt is aligned.

Positioning the monitors

Caution

The monitor suspension system is not designed to support loads.

This could pull down the monitors.

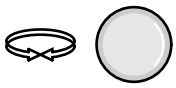
- *Do not place any* load on the monitor suspension system.

Approach the end positions with reduced speed. Do not use the brakes for reducing the speed of the monitor suspension system.

Always ensure that neither the patient nor you or others collide with equipment (especially the monitors).

Rotating the MSS/DCS

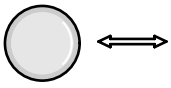
- Grip the handle of the monitor suspension system.



- Press the key for rotary movement.
  – Rotary movement is enabled.
  – Longitudinal movement is braked.
- Rotate the monitors as required.

Moving the MSS/DCS

- Grip the handle of the monitor suspension system.



- Press the key for longitudinal movement.
  – Longitudinal movement is enabled.
  – Rotary movement is braked.
- Push the monitors into the required position.

Make sure to brake the movement of the monitor suspension system at the required target position.

Selecting the image format/zoom stage

Depending on the flat detector installed, the following image formats / zoom stages are available:

For technical reasons, switching to zoom mode does not improve geometric resolution for flat detectors because this function is implemented exclusively by "digital zooming".

Zoom stage	**Input field**	
	FD 20x20 (diagonal)	**FD 30x38 (diagonal)**
Nominal format / zoom 0	25 cm	48 cm
Zoom 1	20 cm	42 cm
Zoom 2	16 cm	32 cm
Zoom 3	8*† cm 10*‡ cm	22 cm
Zoom 4	-	11* cm 16* ** cm
Zoom 5	-	11* ** cm

* ACQ zoom
† Artis dFC/dBC
‡ Artis dBA plane B
** Artis dBA plane A

ACQ zoom

In addition to the regular zoom stages, there is Digital Acquisition Zoom which provides a dose-saving zoom stage.

You can select this additional zoom stage in the same way as the "normal" zoom stages. The selected input field size is shown on the data display.

The dose for this additional zoom stage can be configured by Siemens Service.

Check/select plane (Artis dBC/dBA only)

The last plane in which fluoroscopy was performed is automatically selected.

◆ If necessary, press the **A/B** key on the collimator control module.
– The LED of the selected plane lights up.

Setting the SID (source to image distance)

⇨ Part **System Operation**, Chapter **Unit Movements**, "FD lift / Setting the SID"

Setting portrait/landscape (on systems with FD30x38 only)

⇨ Part **System Operation**, Chapter **Unit Movements**, "Rotating the FD / Setting portrait/landscape"

Changing the zoom stage

Changing from Zoom 2 to Zoom 3 (with flat detector 30x38 only) X-ray is interrupted due to mode change. No live image is displayed for a short time.

◆ Press the **-** or **+** key on the collimator control module.
– The zoom stage is reduced (= larger input field) or enlarged (= smaller input field) by one step.

The size of the active input field is shown on the data display.

Collimation

One of the following primary collimator responses to switching the zoom stage can be configured by Siemens Service:

❑ The collimation size is retained.

❑ The collimation size is retained but the collimation is opened to the edge of the image with **Zoom -**, if collimation is not performed manually (default).

❑ The collimator leaves are fully opened.

❑ Collimation with respect to the monitor is retained.

An automatic control ensures that collimation remains constant if there are any changes in the distance from the focus of the X-ray source to the image receptor plane.

Measuring field (dominant)

If the input field was reduced and a measuring field was selected which would now be cut, it is automatically switched over (center measuring field).

Setting the collimators

Depending on the system configuration, your system can be equipped with different primary collimators. Consequently the collimator control module comes in different versions.

⇨ Part **System Overview / Operating Elements**, Chapter **Operating Elements and Displays in the Examination Room**, "Collimator versions"

The behavior of the collimation when changing the zoom stage can be configured in different manners.

Please ask Siemens Service.

When changing the SID (source to image distance) by raising/lowering the FD, the collimation is automatically adjusted in order to keep the beam limited to the selected field size.

If the c-arm is positioned in the range of ±15° LAO/RAO and ±15° CRAN/CAUD, when changing the SOD (source to object distance) by raising/lowering the patient table, the collimation is automatically adjusted in order to keep the collimated field size in the object plane constant.

Rectangular and iris collimation

The collimator limits the radiation field to the region of interest (organ) or the maximum input field corresponding to the zoom stage.

Speed

The speed of the collimator leaves depends on how far you tilt the joystick: maximum speed with maximum tilt.

The system controls the speed so that the speed on the monitor does not depend on the zoom stage selected.

Check/select plane (Artis dBC/dBA only)

The last plane in which fluoroscopy was performed is automatically selected.

◆ If necessary, press the **A/B** key on the collimator control module.
– The LED of the selected plane lights up.

Selecting the type of diaphragm (with Angio collimator only)

You can select between a rectangular and a circular (iris) diaphragm:

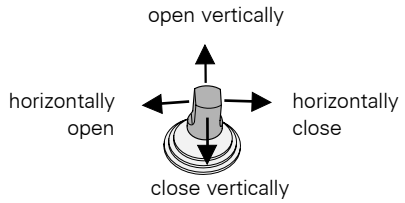
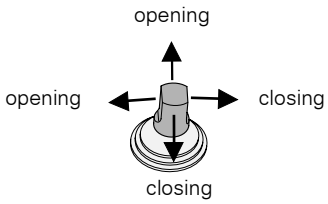
Systems equipped with a Card collimator have only one *rectangular diaphragm*. Therefore, this key is not available on the Card collimator control module.

- Press the **rectangular/iris** key on the collimator control module.
  – The LED of the selected diaphragm type lights up.

Collimation

You can set the rectangular and iris diaphragms with the lower joystick on the collimator control module:

- Tilt the collimator joystick in the required direction.
  – The position of the collimator leaves is shown in the live/LIH image.

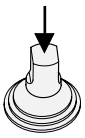
Rectangular collimation	**Iris collimation***
	

* not with Card collimator

The directions refer to the display on the monitor.

With CAREPROFILE, collimation is also possible without radiation on the LIH image.

Resetting the collimation



- Press the collimator joystick down.
  – The collimator leaves are opened completely.

Filter diaphragms (wedge and finger filters)

To compensate for extreme contrast differences, you can use the semitransparent filter diaphragms (wedge and finger filters). These can be positioned anywhere in the image.

❏ Wedge filter
for example, for DSA or cardiological examinations

❏ Finger filters (finger-shaped graduated diaphragm filters)
for example, for DSA aortic arch or peripheral DSA of both legs

Speed

The speed of the filter diaphragms depends on how far you tilt the joystick: maximum speed with maximum tilt.

The system controls the speed so that the speed on the monitor does not depend on the zoom stage selected.

The movement of the diaphragms *ends on the left or right side.*

Rotational adjustment can be continued (even beyond 360°).

Check/select plane (Artis dBC/dBA only)

The last plane in which fluoroscopy was performed is automatically selected.

◆ If necessary, press the **A/B** key on the collimator control module.
– The LED of the selected plane lights up.

Selecting the filter type (with Angio collimator only)

You can select between one wedge filter and a pair of finger filters.

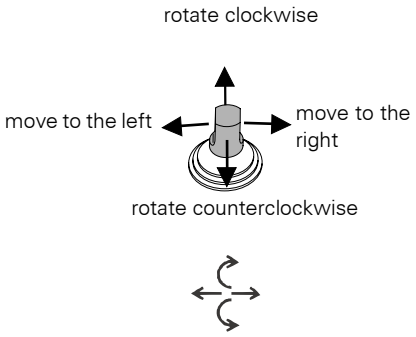
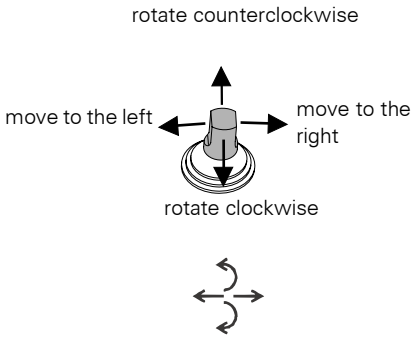
Systems equipped with a Card collimator have only one (single) finger filter. Therefore, this key is not available on the Card collimator control module.

◆ Press the **wedge/finger filter** key on the collimator control module.
– The LED of the selected filter diaphragm type lights up.

Setting the finger filters

A finger filter is set with the upper two joysticks on the collimator control module.

- Check if the LED for the finger filters lights up.[1]
- If not, press the key.
- Tilt the required joystick in the required direction.
  – The position of a finger filter is shown in the live/LIH image.

Left filter*	**Right filter***
	

* with Angio collimator only

The left joystick controls the left filter, the right joystick controls the right filter.

For example, if you move the left filter over and slightly past the right one, then it remains under the control of the left joystick as long as you keep moving it. However, if you release the joystick for more than five seconds, what was the left filter is now the right filter and is controlled by the right joystick.

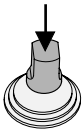
If no finger filter was set previously, it will move into the image parallel to the patient axis as soon as the joystick is tapped briefly. Any finger filter that has been set will remain in that position.

The directions refer to the display on the monitor.

With AREPROFILE, this setting is also possible in the LIH image without radiation.

[1] not with Card collimator

Resetting the finger filters

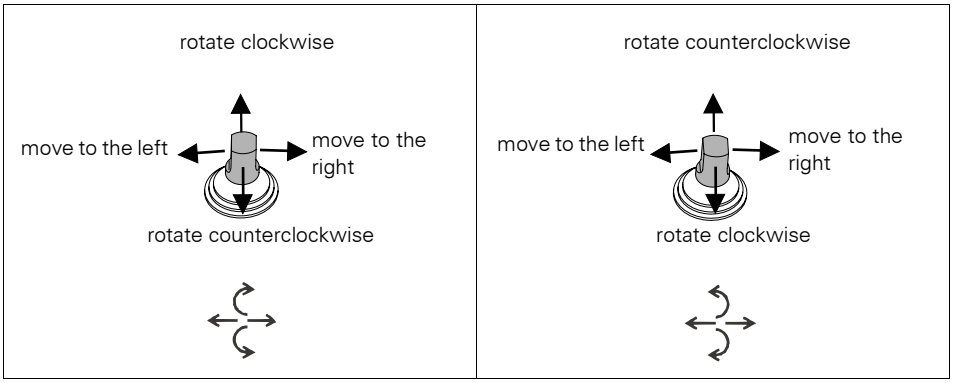


- Press one of the two joysticks down.
  – The finger filter(s) is/are moved out of the beam path.

Setting the wedge filter (not with Card collimator)

The wedge filter is also set with the upper two joysticks on the collimator control module:

- Check if the LED for the wedge filter lights up.
- If not, press the key.
- Tilt one joystick in the required direction.
  – The position of the wedge filter is shown in the live/LIH image.



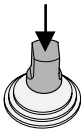
The wedge filter can be set with either of the two joysticks.

If no wedge filter has been set previously, it appears in the image center as soon as the joystick is tapped briefly. Once the wedge filter has been set, it remains in that position.

The directions refer to the display on the monitor.

With CAREPROFILE, setting is also possible in the LIH image without radiation.

Resetting the wedge filter



- Press one of the two joysticks down.
  – The wedge filter is moved out of the beam path.

Storing filter positions or deleting them

When a CARD acquisition program is selected, the filter positions are also stored when storing the positions of stand and table.

⇨ Part **System Operation**, Chapter **Unit Movements**, "Storing programmed positions"

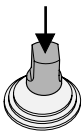
The filter positions are stored only if a CARD acquisition program is selected. The filter positions are restored automatically when a CARD acquisition program is selected.

Storing the filter positions

✓ The active acquisition program is a CARD program.

- Move the unit to the required position.
- Set the primary collimator and the filter diaphragms.

- Press the **Store** key.
  – The LED on the key lights up.
  – The **Programmed Positions** menu appears on the data display.



- Press one of the two filter joysticks down.
- Select the required memory position.

⇨ Part **System Operation**, Chapter **Unit Movements**, "Storing programmed positions"

The filter positions are stored together with the positions of stand and table.

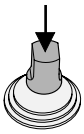
Whenever the projection is reached in a certain angle range, the system will restore the filter positions.

Deleting a single filter position

You can delete the position of a single filter from a programmed position.

✓ The stand and table are in the position which shall be changed.

◆ Press the **Store** key.
– The LED on the key lights up.
– The **Programmed Positions** menu appears on the data display.



◆ Press the corresponding filter joystick (left or right) down and hold it pressed *for more than 3 seconds*.

The position of the single filter is deleted from the programmed position.

Deleting all filter positions

You can also delete the positions of both filters from a programmed position.

✓ The stand and table are in the position which shall be changed.

◆ Press the **Store** key.
– The LED on the key lights up.
– The **Programmed Positions** menu appears on the data display.

◆ Press the **Home** button and hold it pressed *for more than 3 seconds*.

The positions of both filters are deleted from the programmed position.

Resetting the collimation completely (Home)

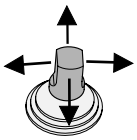
The entire collimation (collimator leaves, wedge and finger filters) can be reset, i.e. moved out of the beam path in one step:

◆ Press the **Home** button.
– Collimator leaves and filter diaphragms are moved into their initial position outside the image.

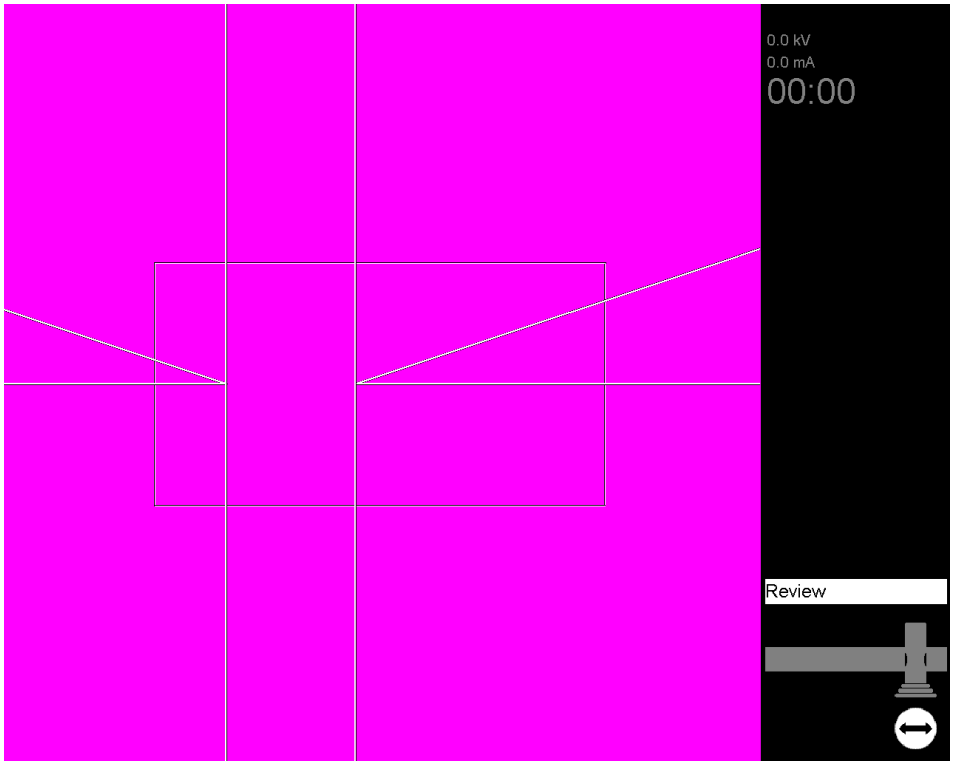
Collimation without radiation with CAREPROFILE

Whenever you move the collimator joysticks, the current positions of the collimator leaves and filter diaphragms are displayed with lines in the image. This allows you to change the collimation without performing fluoroscopy.

Checking the collimator position



- Tap a collimator joystick briefly.
  – The position of the collimator leaves and/or the filter diaphragms is displayed.



Example

The display duration of the CAREPROFILE graphic can be configured by Siemens Service.

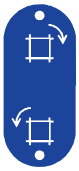
Manual image rotation

The image rotation caused by swiveling of the floor stand or Artis dTC/dTA top stand is normally compensated automatically by collimator rotation ("Multi-space"). The image on the monitor is automatically aligned and always displayed as if the patient were standing in front of the examiner.

Manual rotation

For objects lying obliquely with respect to the image, e.g. arms, the primary collimator or the image can also be rotated manually. In this case, automatic collimator rotation is switched off. This way, collimation can be performed parallel to the object:

Rotating the image clockwise:



- Press the top key and keep it pressed.
  - The upper LED lights up.
  - The collimators / the image rotate(s) clockwise.

Rotating the image counterclockwise:

- Press the bottom key and keep it pressed.
  - The lower LED lights up.
  - The collimators / the image rotate(s) counterclockwise.

A message indicating this appears on the data display.

Switching back to automatic collimator rotation

To switch manual collimator rotation off again:

- Press both keys simultaneously.
  - The collimators / the image return(s) to the normal position.
  - The corresponding LED goes out.
  - The message on the data display disappears.
  - The portrait/landscape rotation of FD 30x38 is also reset.

Grid

The flat detectors are equipped with scattered radiation grids. A grid reduces scattered radiation and thus improves image quality. However, since a grid attenuates primary radiation, it makes a higher dose necessary.

Adults The grid should be used for examining adults. If a grid is not used, the image quality will be impaired due to an increase in scattered radiation.

Infants The scattered radiation grid should be removed for pediatric applications. If the grid is removed, the radiation exposure of the infant will be reduced. The effect of scattered radiation on image quality can be neglected.

Caution

If the grid falls down or is not handled properly, it usually gets damaged even if the damage is not visible.

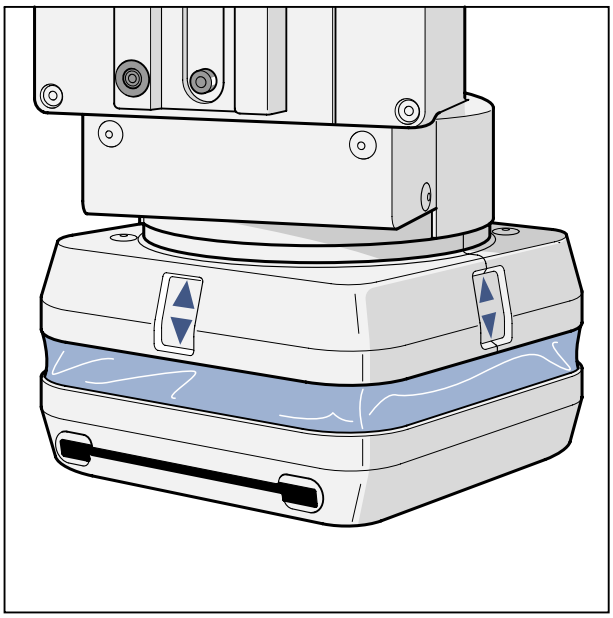
Risk of invisible damage and impaired image quality

- Handle the grid with special care.

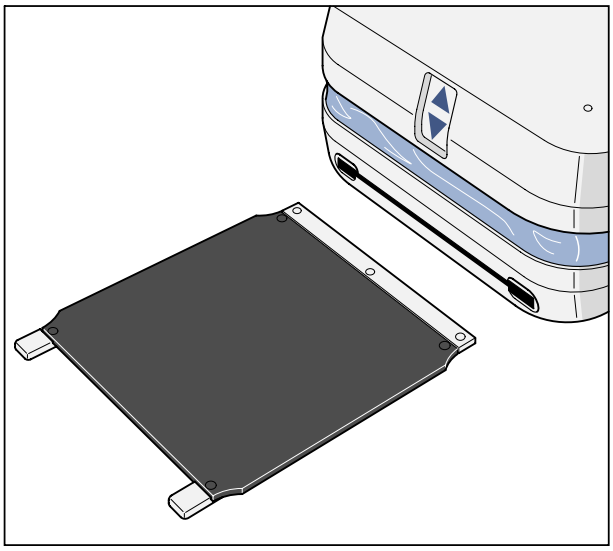
Models On systems with a *flat detector*, the grid is either permanently installed or removable, depending on when the system was delivered.

Grids for inserting at the FD

If the flat detector has a slot, the grid can be removed.



Removing the grid



Make sure to catch the grid when the C-arm is angulated.

- Press the button at the front of the FD.
  – The grid slides out of its holder.
- Pull the grid out to the rear.
- Place the grid in a safe place.

Inserting the grid

- Insert the grid into the FD from the back.
- Pay attention to correct orientation.
  – The arrows on the grid must point toward the detector and
  – the label must point toward the patient.

Operation via Touchscreen Control

Introduction

Selected functions of the imaging system can be operated with the mouse and keyboard of the system panel in the control room or with the joystick and touchscreen of the *touchscreen control* in the examination room.

You can also set the parameters required for an examination (fluoroscopy and acquisition modes) on the imaging system control console, define the display modes on the monitor, and perform important postprocessing functions.

Imaging system

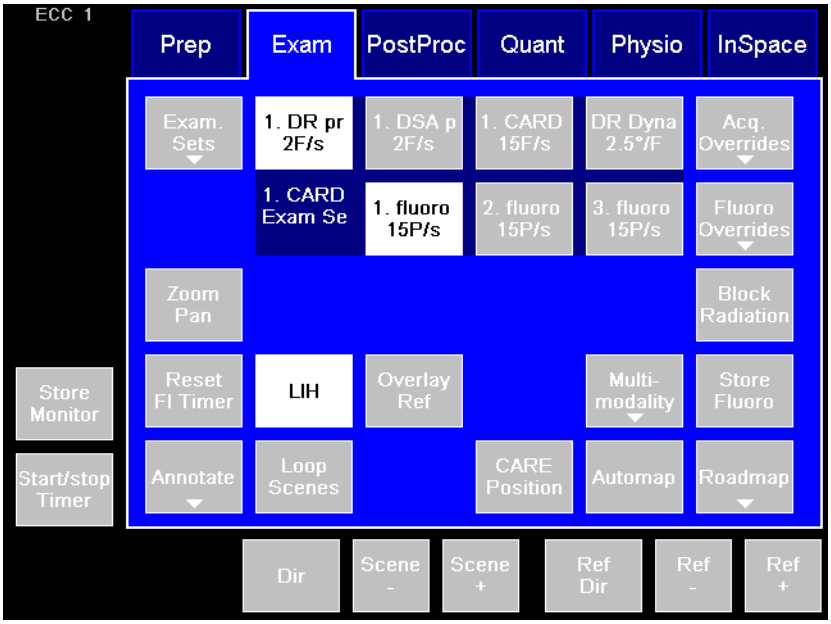
Functions of the imaging system are described in other parts. For application in the examination room, please refer to the following sections of this Operator Manual:

- ⇨ A brief overview of operating elements on the touchscreen control can be found in the Part **System Overview / Operating Elements**, Chapter **Operating Elements and Displays in the Examination Room**, "Touchscreen control".
- ⇨ For notes on the creation and application of exam sets, refer to the Part **Exam Sets**
- ⇨ The postprocessing functions are described in Part **Image Viewing and Image Processing**.
- ⇨ Important information about quantification can be found in Part **Quantification**.

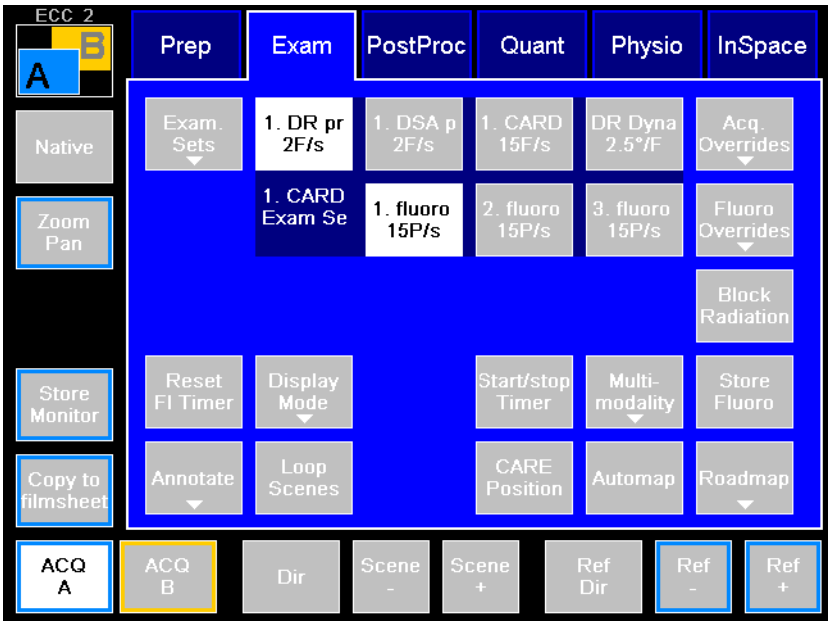
Command inputs on the touchscreen control

The touchscreen control has a touch-sensitive liquid-crystal display. It can display graphics and texts like a conventional computer monitor and at the same time allow you to enter data by pressing the selection fields on the touchscreen, a bit like a membrane keyboard.

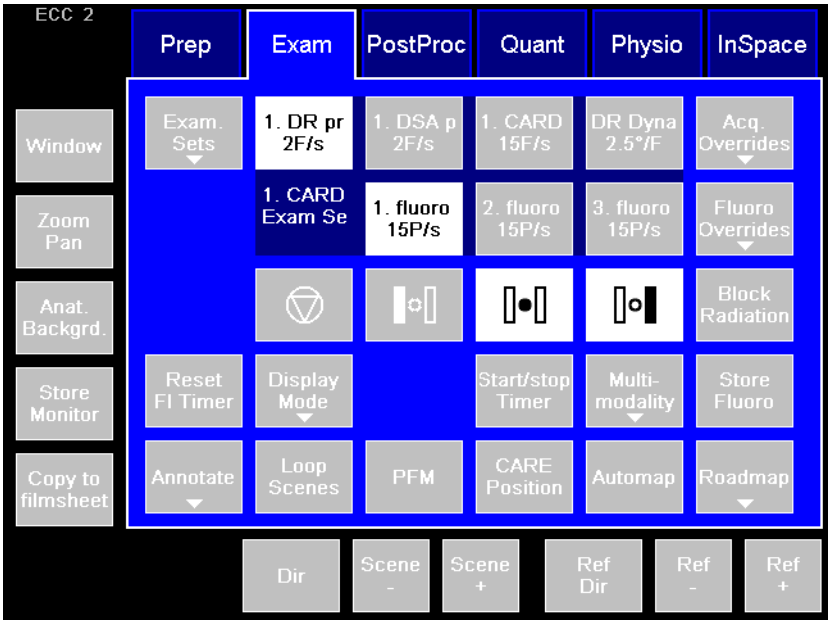
- ⇨ Also see Part **System Overview / Operating Elements**, Chapter **Operating Elements and Displays in the Examination Room**, "Touchscreen control"



Example single plane



Example biplane



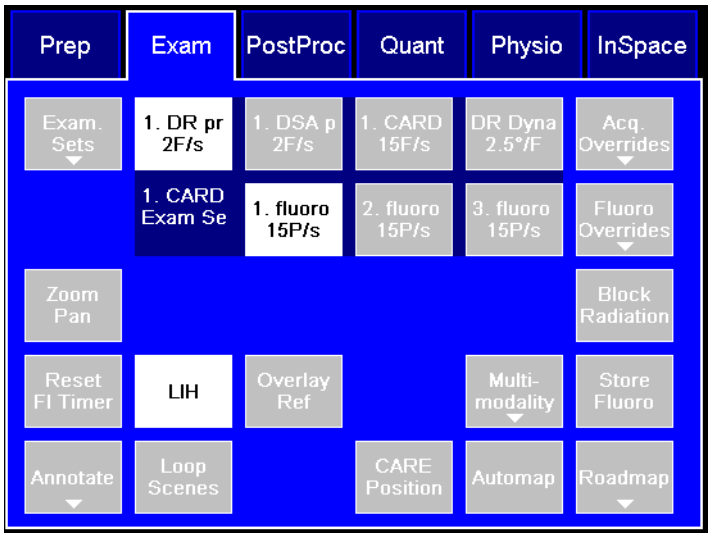
Example Artis dMP

All touchscreen images shown are examples only. Your actually available functions depend on the type of system, the system configuration and the selected profile.

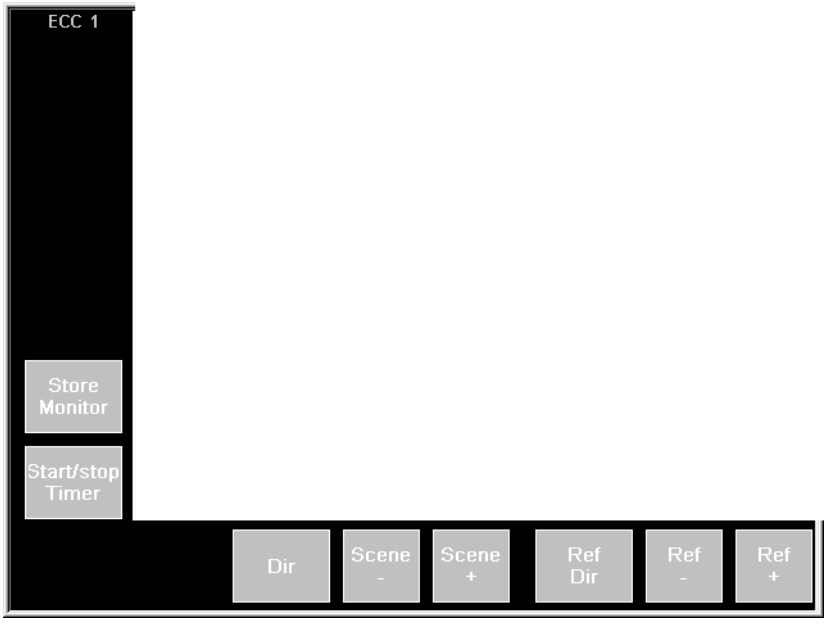
Input areas

The input area of the touchscreen is divided into two parts:

❏ In the stack of *task cards,* you will find selection fields grouped by function.



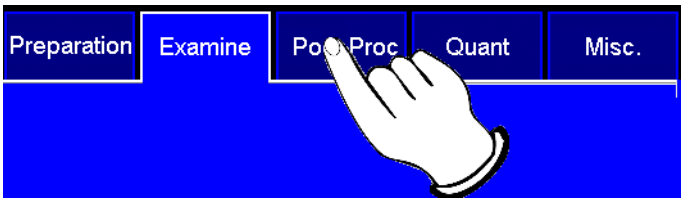
❏ Frequently required functions can be found outside the card stack along the left and the bottom sides, irrespective of the currently active task card.



The selection fields left of the card stack can be programmed by Siemens Service.

Selecting a task card

Like the system console, the touchscreen control allows you to place a task card in the foreground.



◆ To select a specific task card, press the tab of the task card you require on the touchscreen.
– The task card you have selected automatically moves to the foreground.

Status of the selection fields

The appearance of a selection field indicates the status of the function in question:

❑ If a selection field appears with a gray background, you can select it by pressing it.

❑ If the background color changes to white, its function is active and you can deselect the field by pressing it again.

Selection fields with window

If a selection field is marked with an arrow, a window with additional selection fields will be displayed when you activate it.

Example:

◆ Press **Fluoro Overrides**.
– A selection of the available pulse rates appears.

◆ Select the required pulse rate and confirm with **OK**.

Selection fields with joystick

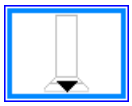
If a selection field is marked with a joystick, you can use the touchscreen control joystick to perform functions on the monitor.

Example:

- Press **Zoom Pan**.
  – Now you can change the size and position of the image using the joystick.

⇨ Also see "Display of the joystick function on the image monitor" on page 77

Selection fields with window and joystick



If a selection field is marked with a joystick and an arrow, both functions are possible.

Example:

- Press **Annotate**.
  – A window displaying the available annotation functions appears.
  – At the same time, you can perform annotations on the screen using the joystick.

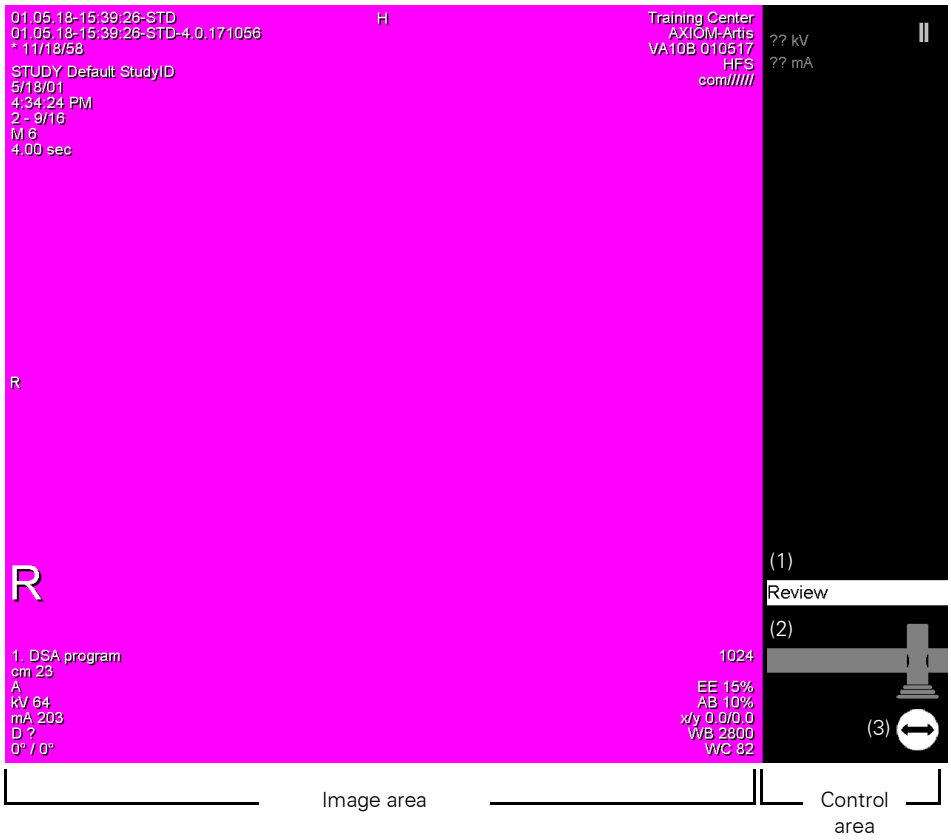
Selecting the acquisition plane (Artis dBC/dBA)

With biplane systems, some of the functions can be selected for both planes. To do so, first switch over to the other plane:

- Press **A/B**.
  – The other plane is selected.

Display of the joystick function on the image monitor

For easier operation, the possible joystick functions are displayed on the image monitor in the examination room. If a joystick function is selected, this is indicated at the bottom of the control area .



(1) Joystick function without button pressed

(2) Joystick function with side function button pressed

(3) Possible directions of joystick tilt

IS joystick functions

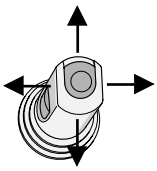
Basically the functions on the touchscreen control are performed in the same way as on the system console. The following operating elements have a corresponding effect:

Function	System console	Touchscreen control
Operating elements	Mouse	Joystick
	Control area on the screen	Touchscreen
	Buttons (icons)	Selection fields (text)
Move pointer	Move mouse left/right/up/down	Tilt joystick left/right/up/down
Activate function / set selection	Click with left mouse button	Press **function key** (left or right)
Confirming changes	Double-click with left mouse button	**Select button** ("fire button") on the top or rear of the joystick

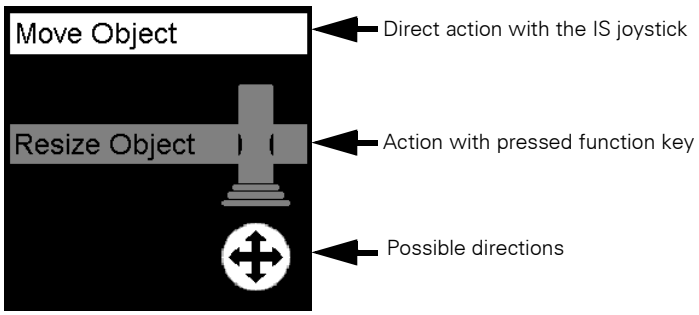
Using the joystick

If you have selected a function, you can control it with the joystick:

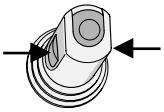
Moving the pointer/selection



- Tilt the joystick in the required direction.
  – The pointer/the selection moves accordingly.



Activating the alternate function / marking (e.g. marking images)



- Press one or both **function buttons** on the side of the joystick.
  – A currently possible function is activated (and displayed) or marked.

Confirming changes

- Press a **selection button** ("fire button") on the top or rear of the joystick.
  – The changes made are stored.

Operation via Voice Control

Important information

Use The Voice Control facilitates the hands-free operation of major functions of your Artis system. It operates independently of the corresponding manual operating elements.

Caution

Radio transmitter too close to a life supporting device

Interference with life supporting device

- Make sure to keep a separation distance of > 22 cm (8.7 inch) between the radio transmitter and a life supporting device for a frequency range of the radio transmitter of 80MHz- 800MHz (in U.S.) and a separation distance of > 42 cm (16.5 inch) for a frequence range of the radio transmitter of 800MHz-2.5GHz.
- In case of interference, turn the radio transmitter off or increase the distance between the interfering devices.

Changes or modifications not expressly approved by the party responsible for compliance could void the user´s authority to operate the equipment.

The Voice Control may be interfered with by other equipment, including portable and mobile RF communication equipment, even if such equipment meets the applicable emissions requirements.

The Voice Control must emit electromagnetic energy in order to perform its intended function. Nearby electronic equipment may be affected.

The Voice Control can be operated by either German or English language commands only. The selection of the command language is done during the set-up phase.

Setup for operation

Switching on the transmitter

◆ Switch-on the transmitter by pressing the "on/off" button inside the housing.

It is ready for use if the battery sign on the transmitter display shows fully charged batteries.

If the battery sign shows discharged batteries, the batteries need to be re-charged.

Switching off the transmitter

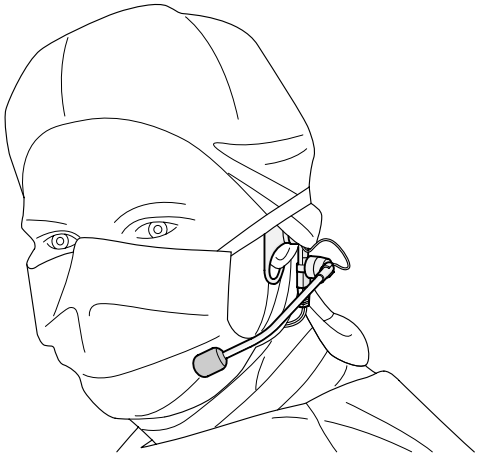
◆ Switch off the transmitter after usage by pressing the "on/off" button inside the housing.

Always put the transmitter into the charging station after usage. This will switch off the transmitter and ensure proper charging of the batteries.
Doing this will also prevent the transmitter from airing any conversation inadvertently to the outside world.

Set up of headset and transmitter

The headset needs to be connected to the transmitter and needs to be worn *over* the mask. The microphone shall not touch the mask or skin.

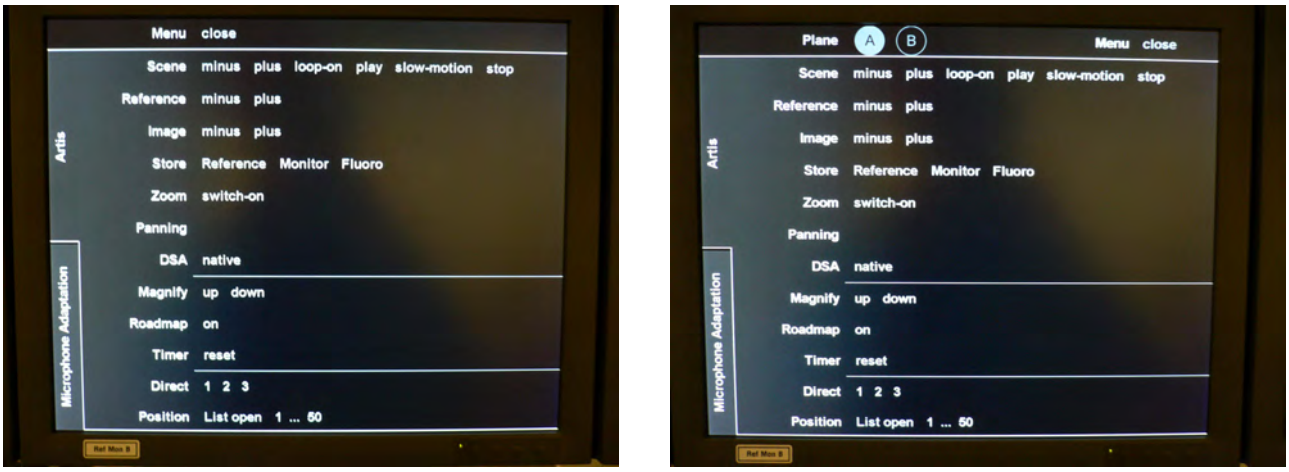
◆ Put on the headset microphone so that the microphone has about 4 cm (1.5 inches) distance to the corner of your mouth.



The transmitter needs to be worn over the lead apron for proper signal transmission.

Voice commands

The voice commands menu is displayed either on the Ref or on the MMV monitor when the voice control application has been started by speaking “Menu open” in the microphone.



Single plane and biplane (plane A active)

On the left side of the menu the keywords are displayed (e.g. “Scene”, “Roadmap”) which are combined with any of the words indicated to their right side. Thus all the possible commands exist of 2 words, e.g. “Scene minus”, “Scene loop-on”, “Roadmap on”.

Make sure that the transmitter is switched on. If a voice command is recognized, it is highlighted on the commands menu and an acoustical feedback (configurable) in form of a short sound is given.

Open voice commands menu

It is configurable on which monitor the voice commands menu shall be displayed.

- Press **Multimodality** and then **Other** on the touchscreen control, if required.

- Speak "Menu open" in the microphone.

Remember this command, because it is not displayed.

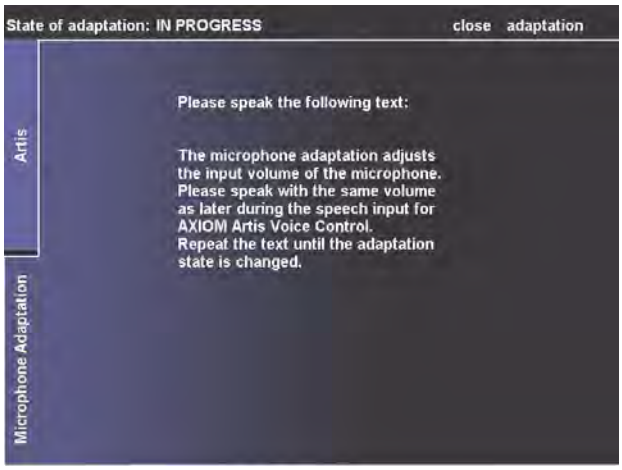
Or

- Press the voice control selection field on the touchscreen console.

Voice commands menu opens.

Microphone volume adjustment

- To activate the microphone volume adjustment, simply speak “Microphone Adaptation” and continue to speak for a few seconds until the display changes from “State of adaptation: In progress” to “State of adaptation: Successful”.


State of adaptation: IN PROGRESS
close adaptation
Artis
Please speak the following text:
The microphone adaptation adjusts the input volume of the microphone. Please speak with the same volume as later during the speech input for AXIOM Artis Voice Control. Repeat the text until the adaptation state is changed.
Microphone Adaptation

Plane selection

- A biplane system can be switched between plane A and plane B with “Plane A” or “Plane B”.

Please consider that the plane is also switched at the touchscreen control.

The commands “Magnify up” or “Magnify down” are applied to the plane selected in the Voice Commands Menu.

Scene

- “Scene minus”: the previously acquired scene is displayed on the life monitor.
- “Scene plus”: the next acquired scene is displayed on the life monitor.
- “Scene loop-on”: loop through all acquired scenes; after the end of the first scene, the second scene is replayed, etc.

- "Scene play": if the replay of the actual displayed scene was stopped, it can be started by this command.
- "Scene slow-motion": the review speed of the scene is slowed down to a configured value.
- "Scene stop": stops the replay or the loop of the actual displayed scene.

Reference

- "Reference minus": displays the previously stored reference image on the ref monitor.
- "Reference plus": displays the next stored reference image on the ref monitor.

Image

- "Image minus": pages the actual displayed scene one frame backward
- "Image plus": pages the actual displayed scene one frame forward

Store

- "Store Reference": stores a reference image and displays it on the ref monitor.
- "Store Monitor": stores the actually displayed image on the life monitor to the scene directory.
- "Store Fluoro" stores up to 300 images from the last fluoro runs.

Zoom

- "Zoom switch-on": the acquired image/scene is enlarged by a factor of two.
- "Zoom switch-off": the image display switches to normal mode.

Acquisition size

For images acquired in a matrix greater than 1K the following commands are available:

- "Acquisition size on": displays the image in the original matrix size as acquired
- "Acquisition size off": displays the image so that it fits completely to the screen.

Panning

If Zoom or Acquisition size is activated, the following commands are available:

- "Panning up", "Panning down", "Panning right", "Panning left": if zoom is activated, the image is panned into the corresponding direction.

DSA

- "DSA native": the display of the actual image/scene on the life monitor switches to unsubtracted mode.
- "DSA sub": the display of the actual image/scene on the life monitor switches to subtracted mode.

Magnification

- "Magnify up": switches to the next larger input format/zoom stage
- "Magnify down": switches to the next smaller input format/zoom stage

Roadmap

- "Roadmap on": activates Roadmap mode.
- "Roadmap reset": resets Roadmap on both planes for a biplane system, e.g if motion artifacts arise. The roadmap process restarts.
- "Roadmap A reset": resets Roadmap in plane A only
- "Roadmap B reset": resets Roadmap in plane B only
- "Roadmap off": deactivates roadmap, return to normal fluoroscopy.

Fluoro timer

- "Timer reset": if the fluoro timer goes off (normally after 5 minutes of fluoro), the timer can be reset with this command.

Direct positions

On the Artis system certain system positions can be assigned to the direct positions I,II,III (3 buttons on the stand control module).

- Instead of pressing the corresponding button, you can select the positions by the voice commands "Direct 1", "Direct 2", "Direct 3".
  – The LED on the button lights up.
- Deflect the stand joystick while pressing down the button on top of the joystick in order to start the movement. When the target position is reached, the LED on the corresponding button goes out and a message is displayed on the data display.

Programmed Positions

On the Artis system often used system positions can be stored in the programmed positions list (button on the stand control module).

- Instead of pressing the button to open the programmed positions list, the voice command “PositionList open” can be used.
- If the list is displayed on the data display, all 50 positions can be selected manually with the stand joystick or by voice command “Position 1”, “Position 2”,..., “Position 50”.

If the desired programmed position is memorized, it can be selected by voice command directly without opening the list first.

- Deflect the stand joystick while pressing down the button on top of the joystick in order to start the movement. When the target position is reached, a message is displayed on the data display.

In order to close the open programmed position list, the voice command “PositionList close” can be used.

The programmed positions list also closes automatically after a configurable timeout.

Close Voice Commands Menu

- "Menu close": closes the voice control menu. Also done automatically after a configurable timeout if displayed on ref. monitor.

The operating time of the transmitter is 6 - 10 hours. After usage put it into the corresponding charging station. This ensures continuous operability.

Never use another charging device or batteries than the ones delivered with the Voive Control. Usage of another charging device may cause severe damage to the Voice Control.

Troubleshooting

❏ The microphone volume adjustment gives an error message that it could not be successfully performed:

◆ Repeat the microphone volume adjustment.

◆ Check that the display on the receiver is highlighted green. If it is highlighted in red, it does not have a connection to the transmitter. Bring the transmitter closer to the receiver. The transmitter shall not be under the lead apron. Check that the same frequency is displayed on the display of the receiver and of the transmitter.

◆ Check that the headset microphone does not touch anything (e.g. skin or tissue)

◆ Check the cable connection between headset and transmitter.

◆ Check if the transmitter and the receiver are switched on.

◆ Check the battery status of the transmitter. If battery sign shows empty batteries, the transmitter needs recharging.

❏ The voice commands are not recognized properly:

◆ Perform a microphone volume adjustment.

◆ Perform the checks described in the previous bullet.

❏ The transmitter does not switch on when pressing the on/off button:

◆ The transmitter needs to be recharged. Please put it in the loading station.

❏ Loading station does not recharge:

◆ Check power supply.

◆ Check if the transmitter has been put correctly into the loading station.

Important information

⇨ Also see volume 1, Part **Safety**, Chapter **User Information**, "Use of video recorders"

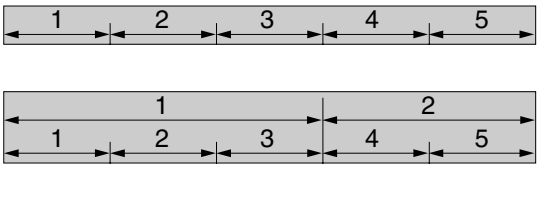
"Programs" - "Chapter" - "Title"

The DVD recorder first stores the recorded scenes in "**programs**".

DVD-R

To ensure that a DVD-R can be played back on commercial DVD players, the structure of video DVDs must be created on the DVD-R: "**Title**" - "**Chapter**".

This process is called *finalization*.



Example of the data structure of a DVD-R

Pre-finalization

By pressing the **STOP** button during the recording (DVD-R), you can determine when a new chapter is to be created after finalizing.

This starts a *pre-finalization* process that takes several seconds.

During the finalization or pre-finalization process no recording is possible with the DVD recorder. (However, fluoroscopy/aquisition on the AXIOM Artis is not disabled.)

You should pre-finalize, i.e. create a new chapter, at least once per patient for easier assignment of scenes to patients.

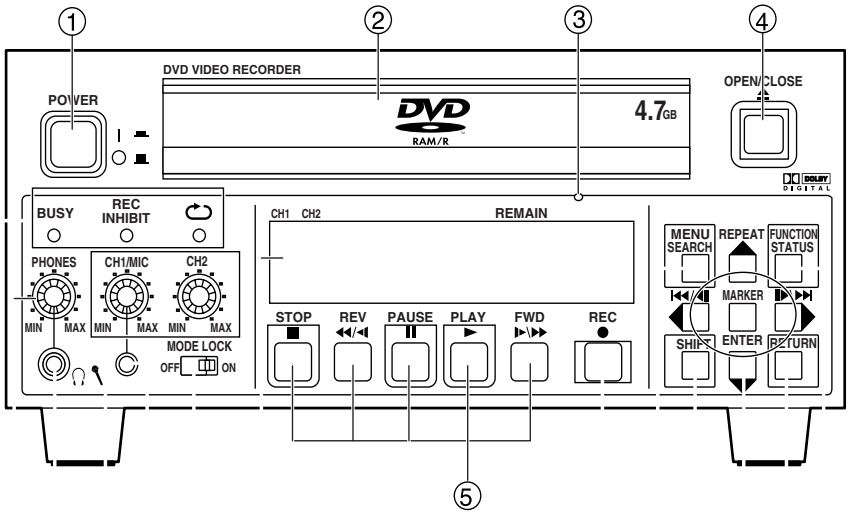
◆ To do this, press the **STOP** button once before each new patient.

After 99 scenes ("programs") you have to pre-finalize, i.e. start a new chapter, to be able to continue the recording.

◆ To do this, press the **STOP** button once.

◆ Otherwise, recording will not continue.

Control elements and displays



(1) **POWER** switch - not needed due to central operation via AXIOM Artis

(2) Disc compartment - DVD is inserted here.

(3) Emergency eject hole
To eject a disc manually, insert the emergency eject pin supplied into this hole.

Switch the unit off before you use the emergency ejection procedure.

(4) **OPEN/CLOSE** button (⏏) for the disc compartment
This button is used to open and close the disc compartment.

(5) STOP button (■)
This button is used to stop the recording and playback.

– Slow-motion playback/search run buttons (**REV** ◀◀/◀▮ , **FWD** ▮▶/▶▶)

– **PAUSE** button (▮▮)

– Playback button (**PLAY** ►)

DVD recording

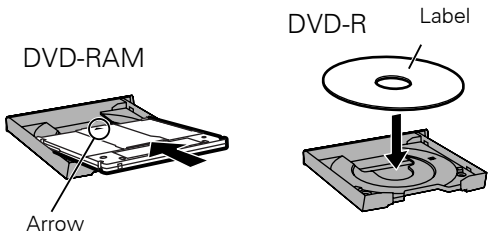
If a new DVD-R/RAM is required:

◆ If necessary, finalize the previous DVD-R straight away.

⇨ “Finalizing a DVD-R” on page 92

Removing/inserting a DVD

- Open the disc compartment by pressing the **OPEN/CLOSE** button (⏏).
- If necessary, remove the DVD-R/RAM.
- Insert the DVD-R/RAM into the disc compartment:
  – Push the DVD-RAM *with cartridge* to the rear.
  – Insert the DVD-R or DVD-RAM *without cartridge* with the label facing up.



A new DVD-RAM or a DVD-RAM that is to be deleted must first be formatted.

A DVD-RAM with cartridge has a write-protection slider.

- Close the disc compartment by pressing the **OPEN/CLOSE** button (⏏).

Formatting a DVD-RAM

DVD-RAMs must be formatted before they can be used for recording.

- Press [**SHIFT**] + [**SEARCH**] to display the menu.

- Using the cursor keys, select "**DISC INFORMATION**" in the menu.
- With the cursor keys, select "**Format**" in the menu and confirm by pressing [**ENTER**].
- Select "**Start**" and confirm by pressing [**ENTER**].

On completion of the formatting process the following message appears:
"**Formatting is complete**"

The formatting process can take up to 70 minutes.

During the formatting process all data on the disc are deleted!

Finalizing a DVD-R

Before a DVD-R disc can be played back on compatible DVD players, it must be finalized. By finalizing the DVD-R disc, it is converted to a DVD-Video disc.

A finalization cannot be undone, and no further programs can be recorded.

Only DVD-R discs that were recorded with this recorder can be finalized.

Programs with a duration of more than 5 minutes are divided into chapters of 5 minutes each.

Markers placed are deleted.

The finalization process can take up to 15 minutes.

During the finalization process the unit must not be disconnected from the power supply.

Creating a DVD-Video disc (Finalizing)

- Press [**SHIFT**] + [**SEARCH**] to display the menu.

- Using the cursor keys, select "**DISC INFORMATION**" in the menu.
- With the cursor keys, select "**Finalize**" in the menu and confirm by pressing [**ENTER**].
- Select "**Start**" and confirm by pressing [**ENTER**].

The finalization process begins. On completion of the process the following message appears: "**Finalizing is finished**".

DVD playback

If fluoroscopy or acquisition is initiated during DVD playback, the DVD recorder immediately switches to recording mode!

Starting playback

- To start the playback, press the [**PLAY**] button.

With DVD-RAMs and non-finalized DVD-Rs, playback begins with the program last recorded.

With finalized DVD-Rs, playback begins at the start of the disc.

Pause

- Playback can be paused at any time by pressing the [**PAUSE**] button.
- If you press this button again, playback will be continued.

Ending playback

- To end the playback, press the [**STOP**] button.

*If the [**STOP**] button is pressed during playback, the location concerned remains stored and playback can be continued from here (continue function). The LED of the **STOP** button lights permanently and the LED of the **PLAY** button flashes.*

*The continue function can be cancelled by pressing the **STOP** button again. After cancellation of the continue function, the LED of the **STOP** button lights permanently and the LED of the **PLAY** button goes out.*

Operator Manual
Examination

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Registering a patient

Before examining a patient, you have to register the patient and select an examination.

Default patient

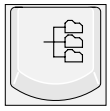
An emergency patient is automatically registered each time the system is restarted. This allows you to perform fluoroscopy and acquisition immediately after switching on the system as soon as the imaging system is ready.

If an X-ray is not performed for this patient entry, the entry is deleted when the system is started the next time.

Export/send all data to be archived to CD-R or the network before you start a new examination.
In case of an error, e.g. of a hard disk, this may result in loss of data.

Taking over patient data from the RIS

The scheduler will automatically be updated with registration information at fixed intervals, as configured in your system.



- Press the **Patient Browser** (**Num .**) key on the symbol keypad.
  – The **Patient Browser** window appears.

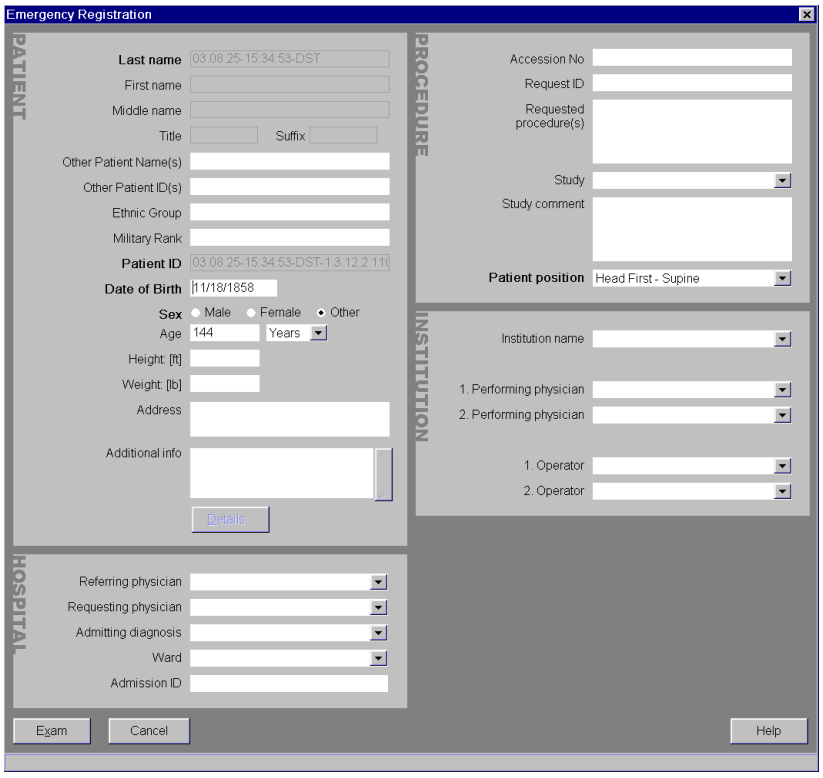
- Double-click on the icon for the scheduler to update it and then open it.
  – All patients who are preregistered for examination on your system are listed in the content area.
- Double-click on the patient to be examined.
  – The **Patient Registration** window opens.
- Add any required data.
- Select the **Patient position** from the list.[1]

➪ "Registering the patient and starting examination" on page 5

[1] Not required for cardiac examinations

Registering an emergency patient

◆ Select **Patient > Emergency** from the main menu or from the **Patient Browser**.
– The **Emergency Registration** window is displayed.



◆ Enter the **Date of birth** and the **Sex** of the patient (if known) and select the **Patient position**[1] from the list (data shown in **boldface** type are mandatory entries).

Patient name, patient ID, date of birth and sex are used for unique identification of a patient in the databases and on archive media.

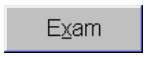
⇨ For more information on **Patient Registration**, please refer to the *syngo* ® documentation.

[1] Not required for cardiac examinations

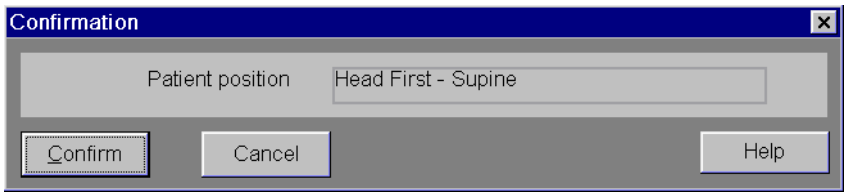
Registering the patient and starting examination

When the system is in "BYPASS FLUORO" mode, or during radiation, the patient cannot be registered for examination.

◆ In this case, click on **Preregister**.



◆ Click on **Exam**.
– A dialog box is displayed in which you must confirm the patient position.[1]



Warning

Incorrect patient position data

Danger of incorrect diagnosis, e.g. confusion of right and left

The examiner is responsible for the correctness of selecting the application and the consequences resulting from it.

◆ Check patient position data in the current image to exclude any errors.

◆ Click on **Confirm** if the patient position is correct.
– The patient is registered.

The **Examination** task card is placed in the foreground and you can start the examination immediately.

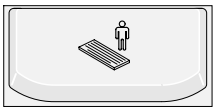
You can enter or change missing patient data at a later time.

⇨ Part **Image Viewing and Image Processing**, Chapter **General**, "Changing patient data"

[1] Does not appear, if only the **Cardiac** profile is configured.

Registering a patient manually

If you want to register a new patient, make sure that you have not selected a patient or study in the **Patient Browser**.



- Press the **Patient Registration** (**Num 0**) key on the symbol keypad.

Or

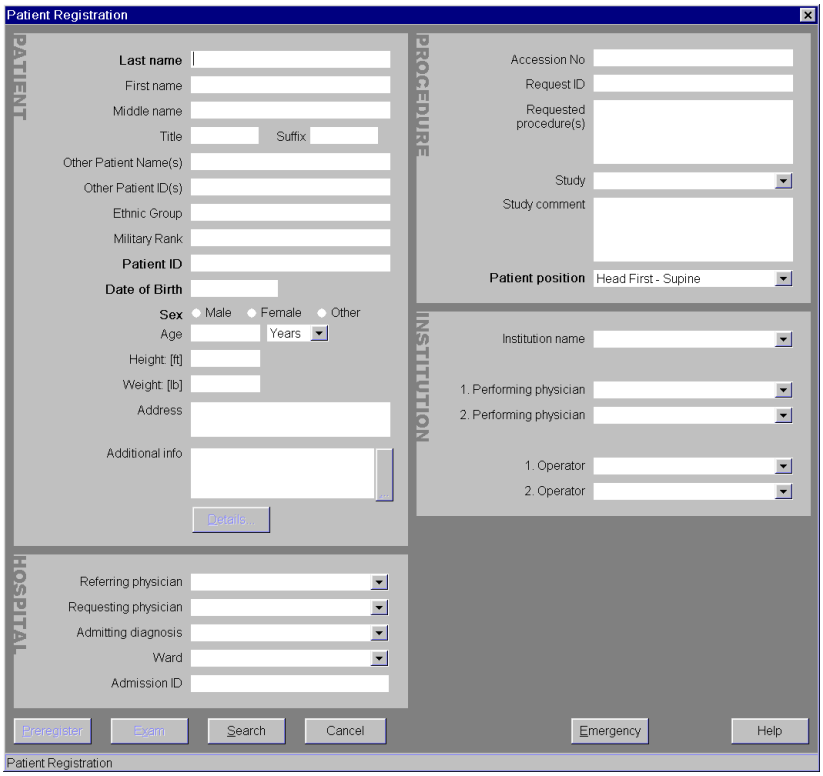
- Call up **Patient > Register**.

Or

- Open the **Patient Browser**.

- Click on this icon.

– The **Patient Registration** window opens.



Do not enter special characters (e.g. \:;#§).
Text entered may be wrong or missing.

- Enter the data (data shown in **boldface** type are mandatory entries).
- Select the required exam program from the **Study** list.
- Select the **Patient position** from the list.[1]

⇨ "Registering the patient and starting examination" on page 5

Preregistering the patient

If you want to register the whole patient list of the day, you can *preregister* the patient.

- Click on **Preregister** after entering the patient data.
  – The patient is put in the scheduler.

All the input fields of the **Patient Registration** window are now empty again. You can enter the data of the next patient.

Taking over patient data from Cathcor

If the patient you require has already been registered on Cathcor, you can accept the patient data from there.

On Cathcor

- Prepare patient registration on Cathcor, possibly with additional data from entries on the database page (+F15).
- Accept the data by selecting **Accept.** .
  – The data are transferred to AXIOM Artis.

On AXIOM Artis

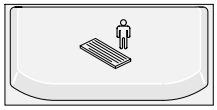
- Select **Patient > Retrieve from Cathcor...** from the main menu.
  – The **Patient Registration** window appears with the accepted data.
- Add any missing data.

⇨ "Registering the patient and starting examination" on page 5

[1] Not required for cardiac examinations

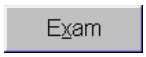
Taking over patient data from Sensis

If AXIOM Sensis is installed, patients must *always* be registered there. Patient registration on AXIOM Artis causes inconsistent patient data on AXIOM Sensis and AXIOM Artis.



- Press the **Patient Registration** (**Num 0**) key on the symbol keypad of the **AXIOM Sensis**.
- Enter the data (data shown in **boldface** type are mandatory entries).
- Select the examination type you require from the **Study** list.

If you are using the **AXIOM Sensis Information System**, you *must* select an examination type from the **Study** selection list. Problem-free work will only be possible if this selection is made.



- Click on **Exam**.
  – The patient is registered at the AXIOM Sensis *and* at the AXIOM Artis.

Preparing the patient and equipment

Transferring and positioning the patient

Positioning accessories

- ◆ Attach the accessories required for secure positioning to the patient table.
- ◆ In particular, attach the handgrips, footboard and foot holder.
- ⇨ Part **Accessories and Auxiliary Devices**.
- ◆ Ensure that the accessories are attached securely and function properly.
- ◆ If necessary, temporarily remove the control consoles from the repositioning area.

When transferring the patient, make sure that no unit movements are initiated inadvertently.

- ◆ Move the units to a transfer position.
- ⇨ Part **System Operation**, Chapter **Unit Movements**, "Moving to system and programmed positions"
- ◆ Transfer the patient using positioning aids.

Comfortable positioning

- ◆ Position the patient comfortably.
- ◆ Make sure that no parts of the patient's body, in particular, arms, legs, and hair, are protruding over the edge of the tabletop.
- ◆ Ensure that the patient uses the grip locations provided where this is possible and necessary (handgrips on Artis dMP).
- ◆ Remove any interfering metal parts and radiopaque objects from the table.

During examinations, always make sure that there are no unwanted objects in the beam path.

Immobilization

- ◆ If necessary, immobilize the patient using the appropriate accessories.

Radiation protection

- ◆ Attach and position the required radiation protection accessories.
- ⇨ Part **Accessories and Auxiliary Devices**.

Attaching the ECG

For ECG monitoring of the patient or ECG-triggered fluoroscopy:

- Connect the ECG electrodes and cables in such a way that they do not appear in the beam path.
- Check the ECG curves on the monitor.
- Check the connection of the trigger signal from the ECG unit to the system if the ECG unit is not permanently installed.
- Check the equipotential bonding.

The ECG cables could become tangled with or be broken by moving parts, e.g. the X-ray tube, during C-arm angulation.

- Pay attention to the ECG cables during unit movements.

Preparing for pressure measurement[1]

- Adjust the pressure elements to the atrial plane with the three-way valve.
- Open the three-way valve in front of the pressure element to measure the atmospheric pressure (air).
- Perform zero pressure measurement compensation at the hemodynamic measuring system.

Adjusting the units (stand and table)

- Move the patient table to the required working height.
- Position the tabletop.
- Position the stand and the C-arm as required.

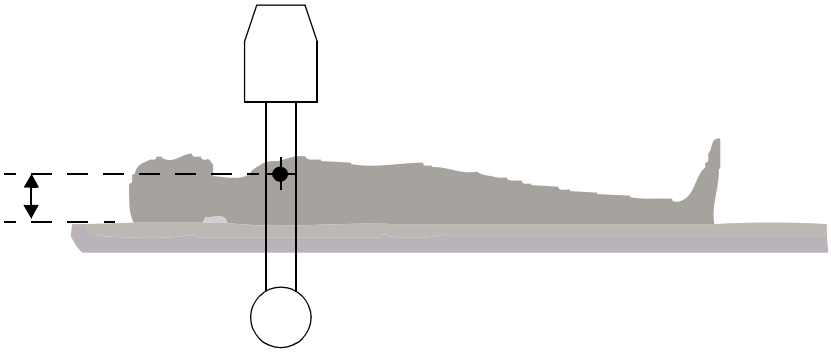
⇨ Part **System Operation**, Chapter **Unit Movements**.

[1] Only required for cardiac examinations

Setting the isocenter

To ensure that you do not have to readjust the table height during an examination with different angulations and to ensure optimum evaluation results, the patient's organ (e.g. heart) or region of interest must be positioned in the isocenter of the C-arm.

Depending on matress thickness and patient thickness, isocentric movements are restricted.

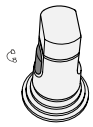


Isocenter distance

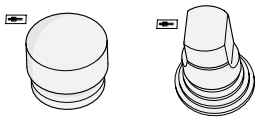
The data display shows the distance between the tabletop (without mattress) and the object of interest in the isocenter.

In this way, you can position the patient without fluoroscopy.

Positioning the patient approximately (without fluoroscopy)



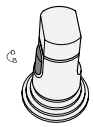
- Place the C-arm in frontal position, if it is not already positioned there.



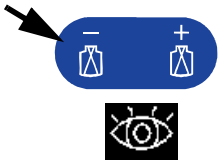
- Roughly center the organ in the beam path.
- Estimate the distance of the organ to be examined from the tabletop (T.O.D.).

- Set the table height so that the required distance is shown on the data display.

Positioning an organ in the isocenter with fluoroscopy



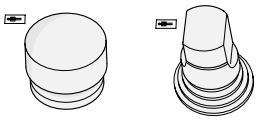
◆ Place the C-arm in a.p. position.



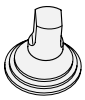
◆ Select the overview format (zoom 0).

Performing fluoroscopy in the p.a. position;
– for cardiac acquisition with deep patient inspiration.

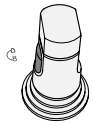
◆ Press the FLUORO footswitch.



◆ Position the tabletop so that the organ of interest is centered.



◆ If necessary, activate the radiation field limitation and collimate the object.



◆ Place the C-arm in lateral position.

Performing fluoroscopy briefly:

◆ Press the FLUORO footswitch.

◆ Center the organ in the lateral beam path by raising or lowering the table.

Storing the isocenter height

⇨ Part **System Operation**, Chapter **Unit Movements**, "Stopping in the isocenter"

Task cards for the examination

With the **Examination** task card at the system console and **Exam** and **Prep** (preparation) task cards at the touchscreen control you can view and edit the parameters for the examination.

At the monitor of the system console in the control room

Single plane system

In case of a single plane system, the control area is located on the right.

Calling up the Examination task card

◆ Click on the tab of the **Examination** task card (of the required plane).

Or

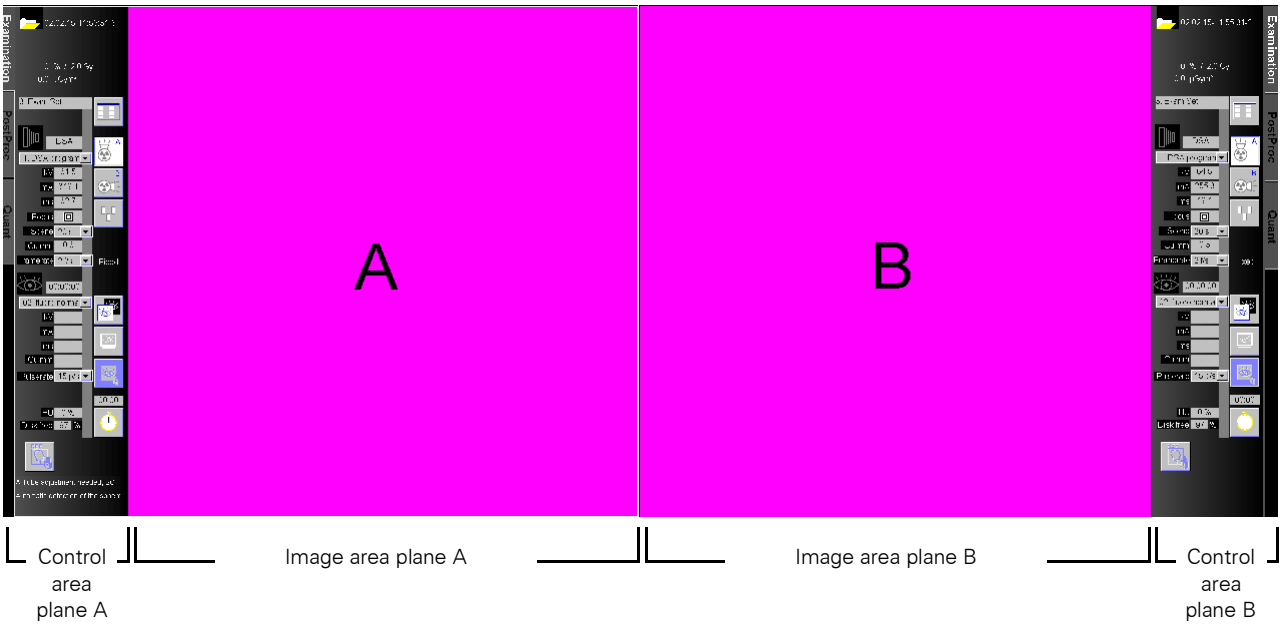
◆ Press **F5**.
– The **Examination** task card is placed in the foreground.
– The current parameters are shown in the control area.

Biplane system

On systems with two acquisition planes, you will find the control area:

❑ on the left or right for plane A (floor stand)

❑ on the right for plane B (top stand)



Example

Using the other plane

You can set the parameters separately for each plane independently of one another.

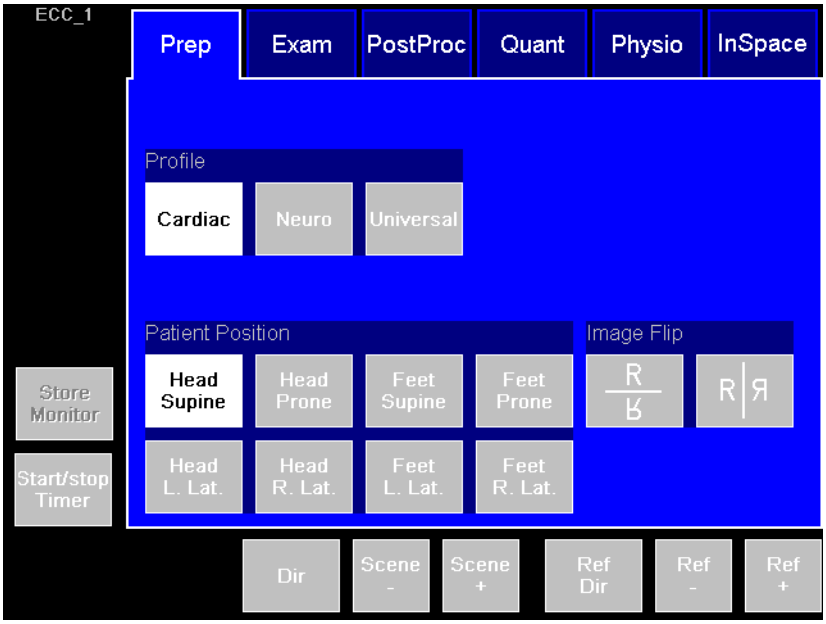
◆ Move the mouse pointer from one monitor to the other.

At the touchscreen control in the examination room

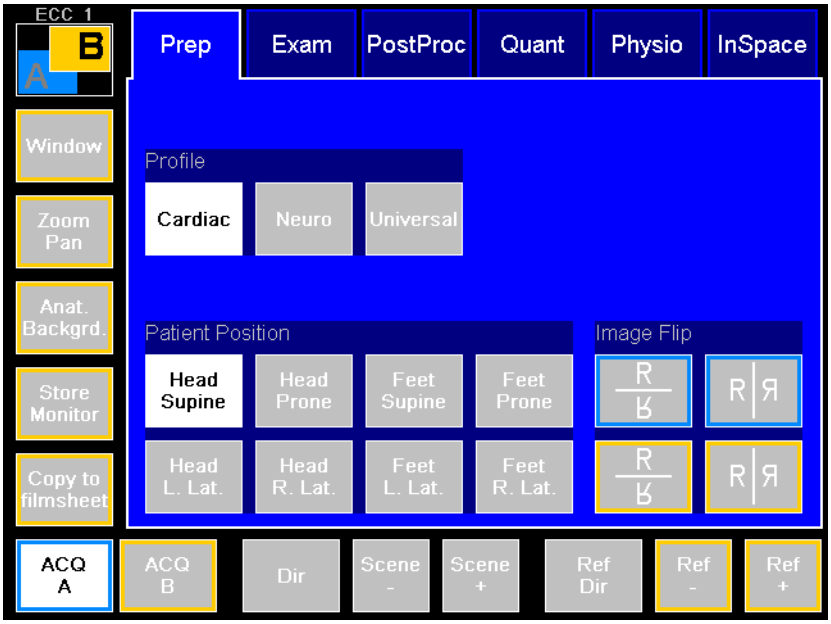
Preparations

On the **Prep** (preparation) task card you can select the user profile (configuration-specific) and the patient position and flip images.

If only the **Cardiac** profile is configured, the **Prep** task card will not appear.



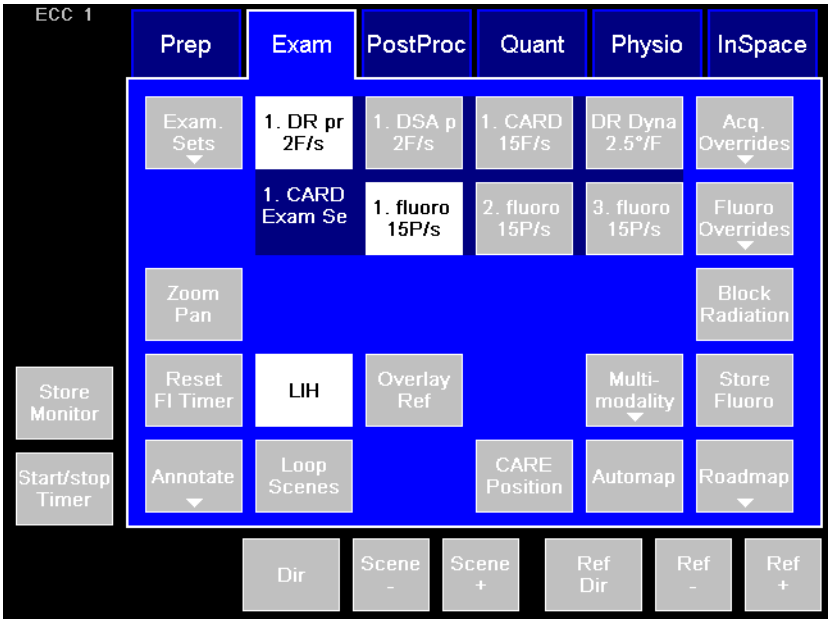
Prep task card single plane (example, depends on system and configuration)



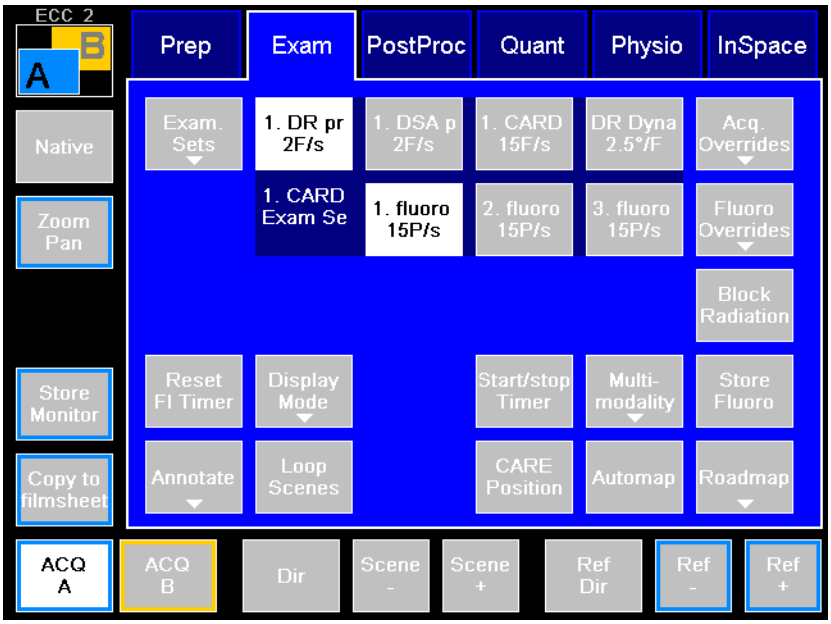
Prep task card biplane (example, depends on system and configuration)

Examination

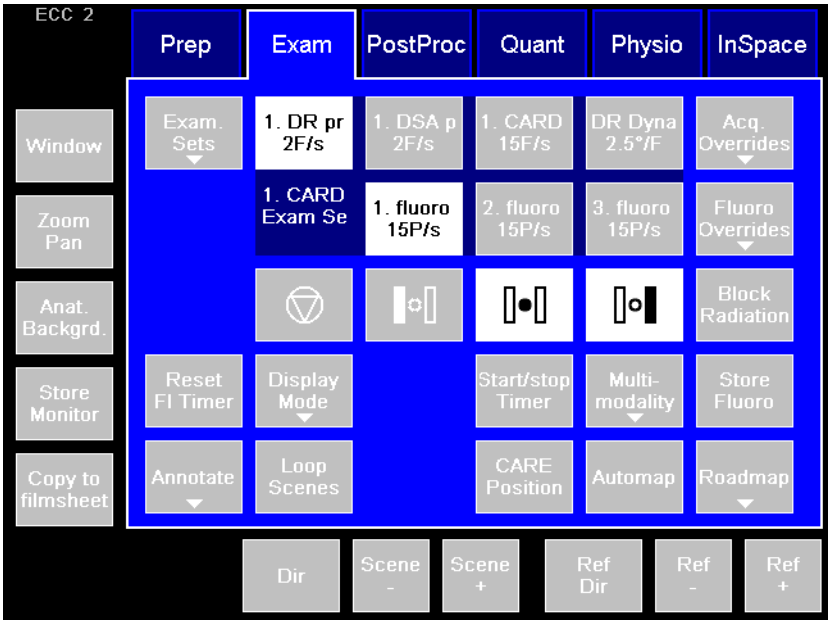
You can set parameters which are important for the examination on the **Exam** task card and also down the left and along the bottom outside the stack of task cards.



Exam task card single plane (example, depends on system and configuration)

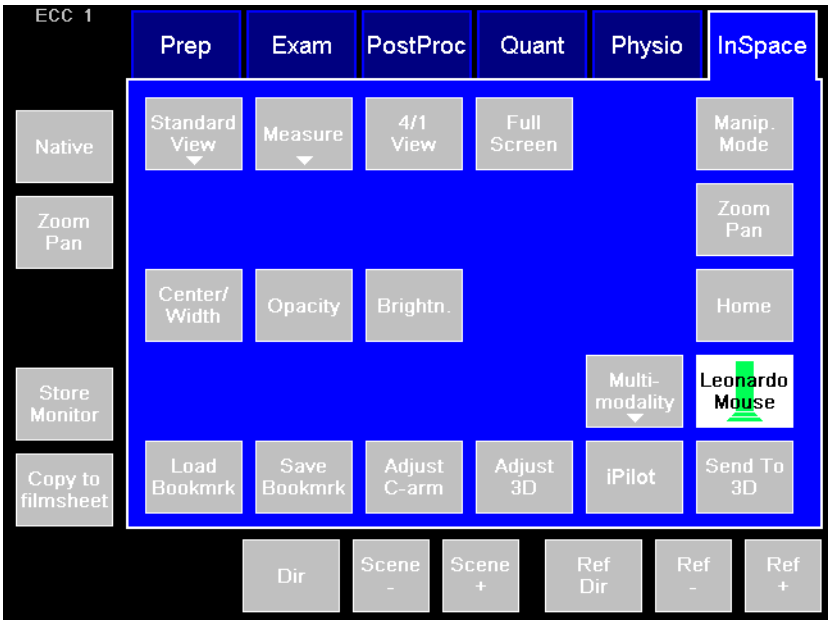


Exam task card biplane (example, depends on system and configuration)



Exam Task card Artis dMP (example, depends on system and configuration)

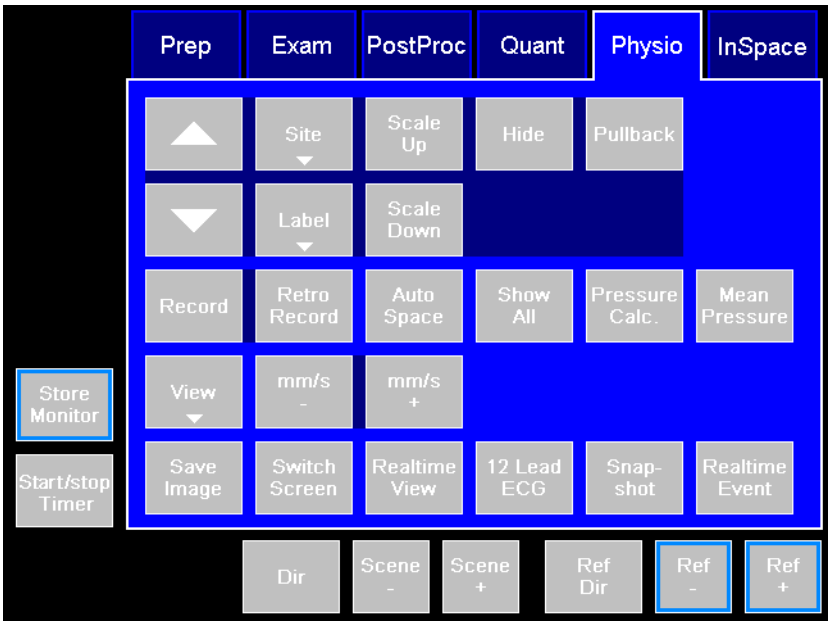
InSpace If **InSpace Reconstruction** is installed, the additional **InSpace** task card will be available at the touchscreen control.



➪ You will find detailed information in the **InSpace Reconstruction** Operator Manual.

AXIOM Sensis

If **AXIOM Sensis** is installed, the additional task card **Physio** will be available at the touchscreen control.



Example

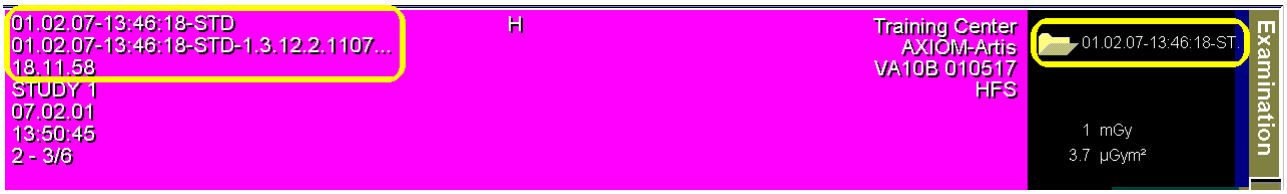
➪ You will find detailed information in the **AXIOM Sensis** Operator Manual.

Parameters for the examination

Checking/changing patient data

Once a patient has been registered, the data of this patient are displayed on the monitor:

- ❏ the active *examination patient* at the top left in the image area on the monitor in the control room and in the examination room (not until after fluoroscopy or acquisition)
- ❏ the active *postprocessing patient* on the top right in the control area on the monitor in the control room



Display in the control room

Display in the examination room

The active examination patient and the active postprocessing patient *can be different*!

◆ Click on the **Examination** tab to see the patient registered for examination.

Checking patient data

You can check the following patient data on the top left in the image area:

- ❏ Patient name
- ❏ Patient ID
- ❏ Patient's date of birth

You will also find the name of the patient in the control area next to the folder icon.

Checking/changing the patient position

The patient position entered by you automatically results in correct orientation of the display on the monitor (horizontally and vertically), i.e., fluoroscopic images and acquisitions are displayed as if the patient was standing in front of the viewer and facing the viewer.

Warning

Incorrect patient position data

Danger of incorrect diagnosis, e.g. confusion of right and left

The examiner is responsible for the correctness of selecting the application and the consequences resulting from it.

- Check patient position data in the current image to exclude any errors.

Warning

Misusing the patient position to flip an image

Risk of misinterpretation and incorrect diagnosis

- Always enter the patient position correctly.

Siemens Service can configure whether the patient position will be entered in the image data (DICOM Header) or not.
Contact Siemens Service if you want to have this configuration changed.

The following patient positions are possible:

Patient position (English term)	**Display on the touchscreen**	**Abbreviation in image** (English)
Head First - Supine (Head First - Supine)	**Head Supine**	HFS (H SP)
Head First - Prone (Head First - Prone)	**Head Prone**	HFP (H PR)
Head First - Left Lateral (Head First - Left Lateral)	**Head L. Lat.**	HFDL (H LL)
Head First - Right Lateral (Head First - Right Lateral)	**Head R. Lat.**	HFDR (H RL)
Feet First - Supine (Head First - Supine)	**Feet Supine**	FFS (F SP)
Feet First - Prone (Feet First - Prone)	**Feet Prone**	FFP (F PR)
Feet First - Left Lateral (Feet First - Left Lateral)	**Feet L. Lat.**	FFDL (F LL)
Feet First - Right Lateral (Feet First - Right Lateral)	**Feet R. Lat.**	FFDR (F RL)

Patient positions and abbreviations used for them

Explanation:

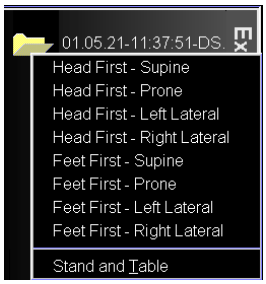
- ❏ Head first: head at the head end of the table
- ❏ Feet first: feet at the head end of the table

At the system console in the control room

You have already defined the patient position during patient registration.

⇨ “Registering a patient” on page 3

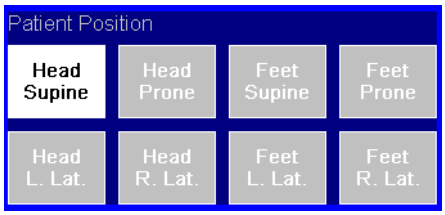
If you want to change the patient position, e.g. after repositioning the patient, proceed as follows:


01.05.21-11:37:51-DS.
Head First - Supine
Head First - Prone
Head First - Left Lateral
Head First - Right Lateral
Feet First - Supine
Feet First - Prone
Feet First - Left Lateral
Feet First - Right Lateral
Stand and Table

- Click on the patient name on the top right-hand side with the right mouse button.
- Select the required new patient position in the pop-up menu.
  – The new patient position is registered and displayed.

At the touchscreen control in the examination room

- Place the **Prep.** task card in the foreground.
  – The current patient position is selected.



- Select the required new patient position.
  – The new patient position is registered and displayed.

Calling up information on the system position

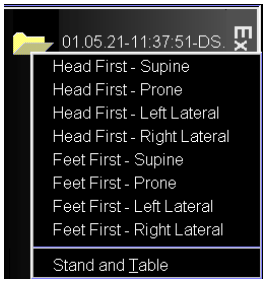
At the data display in the examination room

The data display above the image monitors shows the current data of the installed units (stand, C-arm, table).

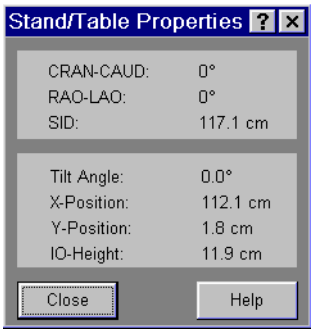
⇨ Part **System Overview / Operating Elements**, Chapter **Operating Elements and Displays in the Examination Room**, "Readings on the data display".

At the system console in the control room

In the control room, you can call up the current positions (angulation data) of the stand(s) and the table position (table height, possibly tilt):


01.05.21-11:37:51-DS
Head First - Supine
Head First - Prone
Head First - Left Lateral
Head First - Right Lateral
Feet First - Supine
Feet First - Prone
Feet First - Left Lateral
Feet First - Right Lateral
Stand and Table

- Click with the right mouse button on the patient folder icon.
- Select **Stand and Table**.
  – A window appears informing you about the current data.



Example of unit data (depends on the system type)

(1) **CRAN-CAUD** / **RAO-LAO**
Angulation of the stand with reference to the patient

(2) **SID** (= Source Image Distance)
the distance between the X-ray source and the flat detector (FD)

(3) **Tilt Angle**
Angle of table tilt

(4) **X-Position**
Longitudinal position of the tabletop with reference to the patient

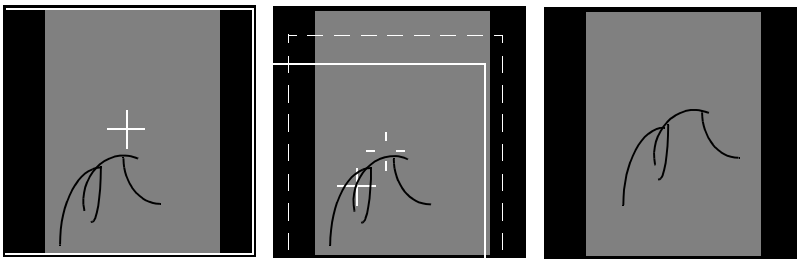
(5) **Y-Position**
Transverse position of the tabletop with reference to the patient

(6) **IO-Height**
Isocenter height

Positioning the patient without radiation - CAREPOSITION

With CAREPOSITION, you can reposition the patient without radiation.

If the patient table or the C-arm is moved, the changed position is displayed graphically in the LIH.



(1) (2) (3)

(1) Start the movement with CAREPOSITION

(2) During the movement

(3) After the next fluoroscopy

In biplane systems, CAREPOSITION can be used in both planes.

CAREPOSITION

At the touchscreen control

◆ Place the **Exam** task card in the foreground.

◆ Activate **CARE POSITION**.

If you move the patient table and/or the C-arm, this is displayed graphically in the image.

❏ A rectangle shows the collimated area.

❏ The center point of the central beam is indicated by cross hairs.

❏ If the C-arm is angulated, the rectangle disappears, but the cross hair continues to show the center point of the central beam.

❏ If the new acquisition position is outside the image, the direction is indicated by an arrow.

The CAREPOSITION diagram is removed when radiation is released.

It appears again if the patient table and/or C-arm are moved again.

Selecting a user profile

Depending on the system equipment and configuration, you can choose between different user profiles.

This changes the assignment of the task cards and the selection fields left of them, which can be configured by Siemens Service.

By selecting a user profile, specific exam sets become available:

- ❑ **Cardiac**[1]
  Programs for cardiological applications
- ❑ **Multipurpose**[1]
  Programs for multifunctional applications
- ❑ **Neuro**[1]
  Programs for neuroradiological applications
- ❑ **Universal**[1]
  Programs for universal applications

At the touchscreen control (only)

- ◆ Place the **Prep.** task card in the foreground.
  – The current user profile is selected.

Maximum configuration

- ◆ Select the required new user profile.
  – The new user profile is registered.
  – The relevant programs are available immediately.
  – The last exam set used in this profile is automatically activated.

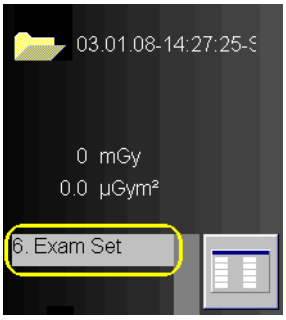
[1] can be activated by Siemens Service

Checking/changing the exam set

An exam set consists of

- ❏ 3 fluoroscopy programs and possibly
  3 assigned roadmap programs and
- ❏ up to 4 acquisition programs.

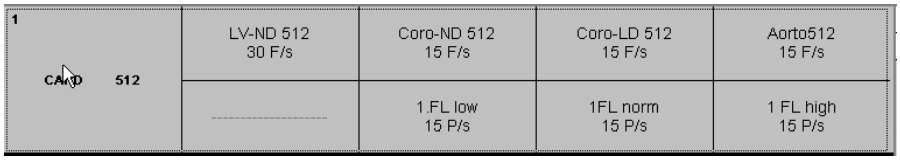
Changing the exam set at the system console



- ◆ Click on the icon for the exam set editor on the right of the displayed exam set.

  – The **Exam Sets** window appears.

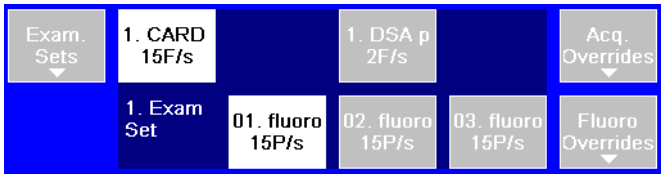
- ◆ Select the required exam set by clicking on the relevant field in the left column.
  – The selected exam set is marked with a dashed border.



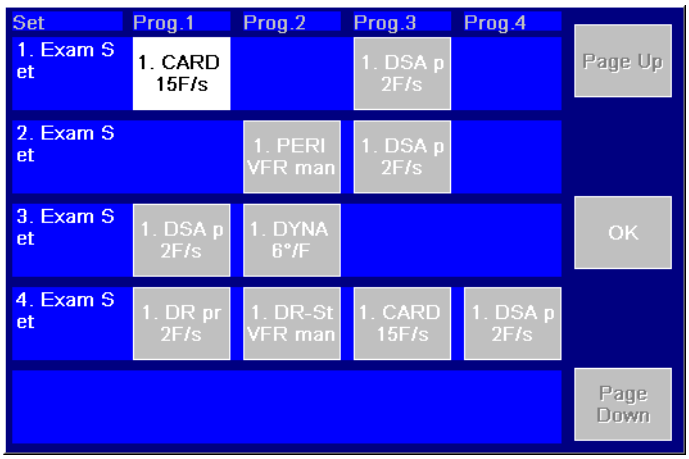
- ◆ Click on **Apply**.
- ⇨ For more information see Part **Exam Sets**.

Changing the exam set at the touchscreen control

- Place the **Exam** task card in the foreground.
  – The current exam set is selected.



- Activate **Exam Sets**.
  – A selection of available exam sets appears.



- If necessary, scroll using the **Page Up** and **Page Down** keys.
- Select the required new examination program.
- Confirm with **OK**.
  – The new exam set is selected.
  – The preset fluoroscopy and acquisition programs are activated.

Checking/changing the acquisition program

On the **Examination** task card in the control area below the exam set, you can read and change the following information about the acquisition program.

Display	Explanation
	Program type – **DR** = **D**igital **R**adiography: acquisition without subtraction – **DSA** = **D**igital **S**ubtraction **A**ngiography: acquisition with subtraction – **Card**: angiocardiography – **DR Stepping** (PERISTEPPING): stepping technique without subtraction – **Perivision**: stepping technique with subtraction – **DR Dyna** (DR-DYNAVISION): rotation angiography without subtraction – **Dynavision**: rotation angiography with subtraction – **DR Scanning**: continuous examination of a linear region
	Acquisition program
	Tube voltage* for acquisition in kV
	Tube current* for acquisition in mA
	Pulse width* for acquisition in ms
	Focus size* (micro/small/large)
	Scene length in seconds [s]
	Copper filter for acquisition in mm
	Frame rate and scene duration – **Fixed** (fixed frame rate) – **VFR Manual** (variable frame rate, manual) – **VFR Time** (variable frame rate, time-controlled)

* calculated from fluoroscopy or post-indication

Caution

If poor image quality results from the set parameters:

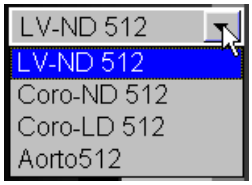
Risk of poor image quality and unnecessary exposure to radiation

◆ Stop radiation immediately and check the parameters or call Service.

Some acquisition parameters are calculated from fluoroscopy.
Therefore you must perform a short fluoroscopy before starting an acquisition.

Changing the acquisition program

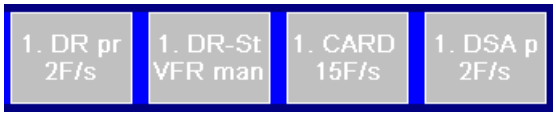
At the system console



◆ Select the required acquisition program.

At the touchscreen control

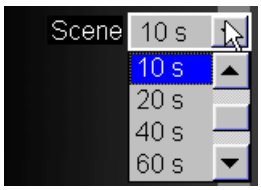
◆ Place the **Exam** task card in the foreground.
– The current acquisition program is selected.



◆ Activate the required acquisition program.

Changing the scene length

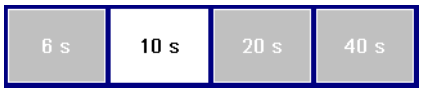
At the system console



◆ Select the required new scene length from the selection list.

At the touchscreen control

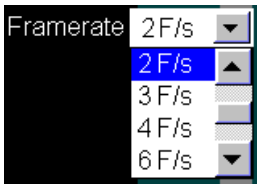
- Activate **Acq. Overrides** on the **Exam** task card.
  – A selection of the available scene lengths is displayed.



- Select the required new scene length.
- Confirm with **OK**.

Changing the acquisition frame rate

At the system console



- Select the required frame rate from the selection list.

At the touchscreen control

- Activate **Acq. Overrides** on the **Exam** task card .
  – A selection of available frame rates appears.

Example

- Select the required new frame rate.
- Confirm with **OK**.

Changing other parameters

Other parameters which are not displayed can be changed in the **Acquisition Program Editor**.

At the system console (only)

- Click on this icon.

⇨ Part **Exam Sets**.

Selecting acquisition plane(s) (only Artis dBC/dBA)

In biplane systems you can select one or both acquisition planes.
(In single plane systems the icons are not available.)

At the system console

At the touchscreen control

Selecting the other plane

- To switch planes, select the other plane.

Or

- First select the second plane and then the first plane.

Selecting both planes

To select both planes, activate the second plane in addition to the first.

Example: Plane B is selected

- Click on the icon for plane A.
  – Both planes appear selected.

Selecting the measuring field (dominant)

Using an incorrect measuring field may result in poor image quality.

- Observe the image while switching over the measuring field.

Depending on the system configuration and the user profiles selected, the measuring field is selected in different ways.

⇨ “Selecting a user profile” on page 25

Cardiology

If you are working with a cardiology system which does not have the Angio option, you cannot select the dominant. The middle dominant is always active. The dominant is only displayed.

Artis dMP

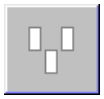
If the **Multipurpose** profile is selected, you can select one or more measuring fields directly on the **Exam(ination)** task card.

At the system console or touchscreen control

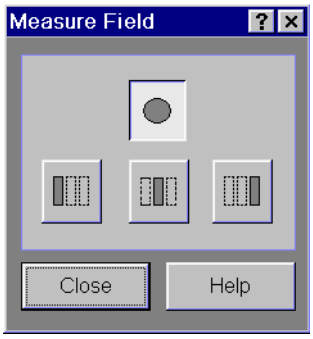
- Activate the required measuring field on the **Exam(ination)** task card.
- Activate a measuring field once again to deselect a dominant.

Other

At the system console



- Click on this icon.
  – The active dominant is displayed in the **Measure Field** window.



- Click on the required new dominant icon(s).
  – A previously active icon is deselected.

For selecting two measuring fields, select them quickly while the white input frame is active.

At the touchscreen control

- Activate **Acq. Overrides** on the **Exam** task card.
  – The available measuring fields are displayed.

- Select the required new measuring field (on the **Exam** task card for the **Multipurpose** profile).
- Confirm with **OK**.

Checking/changing the fluoroscopy program / roadmap

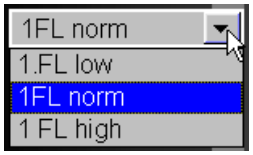
You can read or change the following data for the fluoroscopy program below the data for the acquisition program:

Display	Explanation
	Single plane systems: Elapsed fluoroscopy time (hours : minutes : seconds)
	Biplane systems: Indication of acquisition plane(s) and Elapsed fluoroscopy time (hours : minutes : seconds)
	Fluoroscopy program
	Tube voltage* for fluoroscopy in kV
	Tube current* for fluoroscopy in mA
	Pulse width* for fluoroscopy in ms
	Copper filter* for fluoroscopy in mm
	Pulse rate in pulses per second [p/s]

* Setting range defined in the fluoroscopy program, can only be changed by Siemens Service

Changing the fluoroscopy/roadmap program

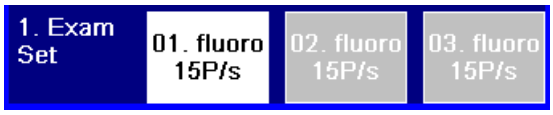
At the system console



- Select the required fluoroscopy/roadmap program.

At the touchscreen control

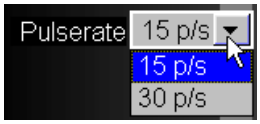
- If necessary, place the **Exam** task card in the foreground.
  – The current fluoroscopy/roadmap program is selected.



- Activate the required fluoroscopy/roadmap program.

Changing the pulse rate

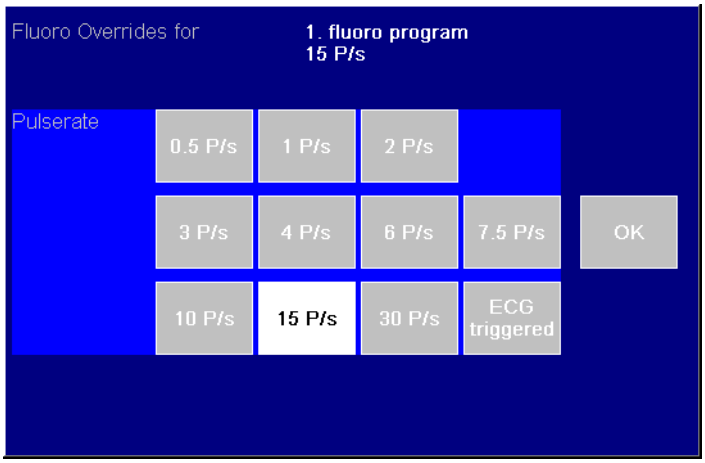
At the system console



- Select the required pulse rate in the selection list.

At the touchscreen control

- Activate **Fluoro Overrides**.
  – A selection of the available pulse rates appears.



- Select the required new pulse rate or **ECG triggered**.
- Confirm with **OK**.

Changing other parameters

Other parameters which are not displayed can be changed in the **Fluoro Program Editor**.

At the system console (only)

- Click on this icon.

⇨ Part **Exam Sets**.

Flipping an image

For example, if the patient is positioned prone during an intervention, you can flip the image so that the catheter moves in the same direction in the image.

You can flip images of a scene horizontally and/or vertically.

The orientation labels are also flipped.

Flipping does not alter the orientation in the scene directory, that is, the image remains as it was.

Warning

Image flipped

Confusion between up/down/left/right can cause incorrect diagnosis!

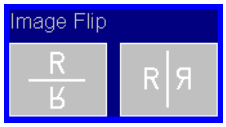
The examiner is responsible for using the functions and interpreting the images correctly and the consequences resulting from it.

- Restore the original image orientation at the end of the examination.

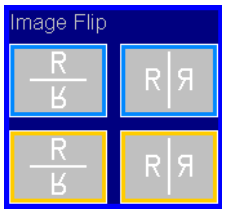
For biplane scenes, only one plane is flipped because, depending on the projection, flipping in one plane might not automatically correspond to flipping in the other plane.

- Contact Siemens Service if you want images always to be displayed flipped.

At the touchscreen control (only)



Possible image flipping functions (single plane)



Possible image flipping functions (biplane)

- Activate the required image flipping function (up/down, left/right, plane A = light blue, plane B = orange).

The next image acquired is flipped (top and bottom or left and right are swapped).

These selection fields are "preselection fields" and cause the next images to be acquired to be displayed flipped.

If you want to flip images that have already been acquired, you can do that on the **PostProc** *task card in the control room.*

General information about fluoroscopy/ acquisition

Caution

Exposure does not stop due to a technical defect

Risk of unnecessary radiation exposure

- If radiation does not stop when no radiation release is pressed, press the next emergency STOP button.

Caution

Overheated or defective flat-panel detector (with FD systems only)

Risk of poor image quality

- Stop radiation immediately and call Service.

Display for active fluoroscopy / acquisition

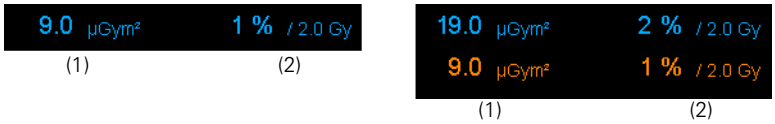
If radiation is released during an examination, this is indicated by the radiation indicators in the examination room and in the control area on the system console in the control room.

Function	passive	active
Acquisition		
Fluoroscopy		

Monitoring the dose

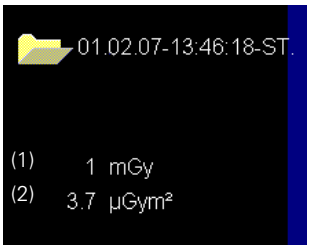
If your system has a dose measuring chamber[1], the following values are displayed at the system console in the control room and on the data display in the examination room:

On the data display



Dose indication on the data display in the examination room

At the system console



Dose indication in the control area on the system console in the control room

(1) Radiation exposure
- *During* fluoroscopy/acquisition:
  the *current* values of the patient dose rate in µGy/min
- *Without* radiation: the *accumulated* values
  of the patient dose in mGy or[2]
  the relative patient dose in % relative to a limit value

(2) Dose area product in µGy · m^2

⇨ Part **Safety (Volume 1)**

Pay attention to the dose display during the examination.
Make sure that the dose values remain within the usual range.

[1] mandatory in the European Union
[2] can be configured; contact your Siemens Service if you require a different display.

Monitoring the status displays

The imaging system keeps you continuously informed about the status of the system.

◆ Please pay attention to the system messages.

⇨ Part **Troubleshooting**, Chapter **System Messages / Troubleshooting**

On the data display

System messages (imaging system) and messages about the units are displayed on the data display (2 lines of text).

Status lines on the data display

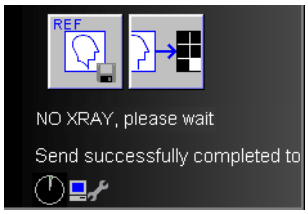
⇨ Also see Part **System Overview / Operating Elements**, Chapter **Operating Elements and Displays in the Examination Room**, "Messages"

At the system console

Messages are displayed on the task cards on the system console monitor:

❑ line at bottom of image (1 line of text)

❑ status area in lower part of control area (2 lines of text and 1 line of icons)



Message lines at the bottom of the control area on the monitor

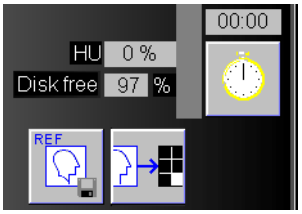
⇨ Also see Part **Troubleshooting**, Chapter **System Messages / Trouble-shooting**, "Message lines"

Monitoring the available storage capacity

At the system console

Scenes/images

The **Examination** task card on the monitor of the system console indicates the available storage capacity for scenes/images in % next to "Disk free".



Displays at the bottom of the control area on the monitor

- Pay attention to this indicator.

Message

If the storage space available for scenes/images has run out, a warning message is displayed.

⇨ Part **Troubleshooting**, Chapter **System Messages / Troubleshooting**, "Memory full!"

- If you need more storage space, delete previously archived patients.

⇨ Part **Image Viewing and Image Processing**, Chapter **Closing Postprocessing**, "Deleting patients/studies/series/scenes"

Other resources

Your system also monitors the memory usage and the storage capacity of the main database, the scheduler database and the exchange board (virtual memory).

- Pay attention to this indicator too.

⇨ Part **Troubleshooting**, Chapter **System Messages / Troubleshooting**, "Resource display"

Please note that this indicator does *not* include the storage capacity for scenes/images.

If more resources are needed:

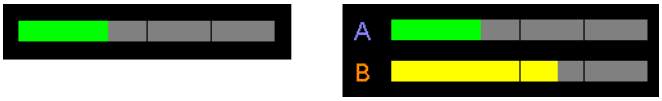
- Delete patients from the scheduler in the **Patient Browser** or remove already printed films from the virtual film sheet.

Monitoring the thermal load of the X-ray tube assembly

Display

The thermal load of the tube in HU (Heat Units) is displayed on the data display by colored bars (green - yellow - red) and on the system console as a percentage.

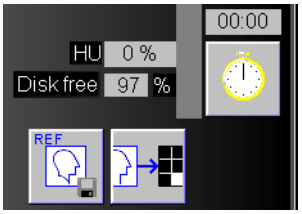
On the data display



Indication on the data display in the examination room

⇨ Also see Part **System Overview / Operating Elements**, Chapter **Operating Elements and Displays in the Examination Room**, "Tube load"

At the system console



Displays at the bottom of the control area on the monitor

In biplane systems this is displayed separately on the monitors of both planes.

Message

If the tube load becomes critical, a warning message will be displayed.

◆ Reduce the tube load, e.g. using (tube cooling) pauses or a lower frame rate.

Blocking radiation

In some cases, for instance when the patient is repositioned or while cleaning, it can be useful to block radiation to prevent it from being released inadvertently.

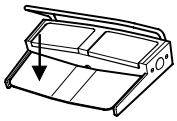
At the touchscreen control (only)

- Activate **Block Radiation** on the **Exam** task card.
  - The selection field appears selected.
  - It is not possible to release radiation.

Fluoroscopy

Single plane

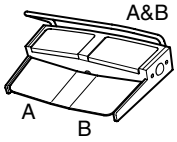
Using the FLUORO pedals

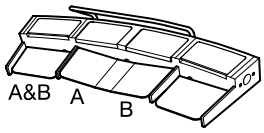


- Operate the **FLUORO pedal** of the footswitch.

Biplane

With biplane systems you can perform fluoroscopy in one plane or in both planes:





- Operate the correct **FLUORO pedal** of the footswitch.
  - The radiation indicator(s) light(s) up during radiation.
  - Fluoroscopy images appear on the monitor.
  - In each case the last fluoroscopy image remains displayed on the monitor after fluoroscopy is completed (LIH = **L**ast **I**mage **H**old).

Switching roadmap on/off

At the system console

- Click on the roadmap icon.

At the touchscreen control

- Activate **Roadmap** in the **Exam** task card.

⇨ Chapter **Subtracted Fluoroscopy: Roadmap**

Storing images as Store Monitor

You can store any image currently displayed, even during fluoroscopy, as a new "acquisition" (**Store Monitor**).

You can store a maximum of 256 **Store Monitor** *images per examination and plane.*

At the system console

- Click on this icon.

At the touchscreen control

- Activate **Store Monitor** (to the left of the card stack).

  – The image is stored as "Store Monitor" on series or image level.

Storing a fluoroscopic scene

You can store the last fluoroscopy (or roadmap) as a scene.

Fluoroscopy performed with biplane pulse reduction cannot be stored as scene.

At the system console

◆ Click on this icon.

At the touchscreen control

◆ Activate **Store Fluoro** on the **Exam** task card.

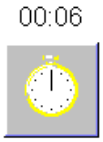
Using the timer

The system is equipped with an integrated timer for exact time measurements, i.e. for dilatations. This timer appears as a digital time display.

The timer runs up to a maximum count of 59 minutes and 59 seconds.

Then it automatically stops and is reset to 00:00.

At the system console



◆ Use the timer icon.

At the touchscreen control

◆ (De)activate **Start/stop Timer** (to the left of the card stack).

Starting the timer

◆ Activate the timer icon.
– The timer starts.

Stopping the timer

- Activate the timer icon again.
  – The timer stops.

Resetting the timer

- Activate the timer icon a third time.
  – The timer is reset to 00:00 and restarts.

Resetting the fluoroscopy signal

It is possible to configure whether fluoroscopy should be blocked after several minutes of *uninterruped* fluoroscopy, for instance, after every 5 minutes.

If the elapsed fluoroscopy time exceeds the preset value (service configurable range 1 ... 5 minutes), a warning signal will sound and a message box will appear.

For safety reasons, radiation will be blocked after 10 minutes of uninterrupted fluoroscopy.

In this case, you can continue with fluoroscopy by realeasing the FLUORO pedal and pressing it again.

When a new patient is registered, the fluoroscopy time is automatically reset to zero.

The elapsed fluoroscopy time of an examination is automatically recorded in the **Exam Protocol** as soon as the patient is completed.

Resetting the warning signal

At the system console

- Confirm with **OK** in the message box to continue working.

At the touchscreen control

- Activate **Reset FI Timer** in the message box or - if you want to reset the signal before intervening, for example, - on the **Exam** task card.

Or[1]

◆ Operate a **FLUORO pedal** on the footswitch.

– The warning signal is switched off.
– The fluoroscopy time will start running again.

If the preset value is exceeded again, the procedure will be repeated.

Acquisition

Caution

Acquiring thin objects (with FD systems only)

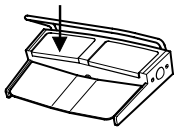
Risk of unnecessary radiation exposure due to incorrect dose.

◆ Always perform fluoroscopy prior to acquisition.

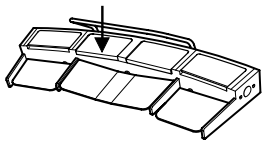
Using the handswitch

◆ Press the **acquisition button** (two stage) of the handswitch.

Using the footswitch



◆ Press the **acquisition pedal** of the footswitch.



– The radiation indicator(s) light(s) up briefly.
– The acquisitions (scenes) are stored as set in the acquisition program and appear on the monitor.

[1] can be configured by Siemens Service

Reference Images and Display Modes

Reference image

Either a fluoroscopy image (LIH) or an image from a digital acquisition scene (subtracted or unsubtracted) can be stored as the reference image.

Alternatively, an image from a different modality, e.g. CT, MR, can also be stored as reference image.

Other reference image

If a display mode with reference image is selected for fluoroscopy, the reference image last stored will always be retrieved automatically. If you want to display a different reference image which was stored previously, you must select it first.

⇨ Part **Image Viewing and Image Processing**, Chapter **Managing and Viewing Scenes/Images**

Reference image monitor(s)

In systems with one or more reference image monitors, the reference image is displayed on this/these separate monitor(s).

Automap

Using **Automap** you can to restore the acquisition position of an existing reference image or to display the reference image of the current system position.

⇨ Part **System Operation**, Chapter **Unit Movements**, "Automap"

Overlay Ref

You can also superimpose the (inverted) reference image on the current fluoroscopic image on the live image monitor (**Overlay Ref**).

Additional color display

If an additional color display is installed on your system, an image source from a different modality can be displayed on it as a reference.

Storing reference images

Storing an Artis image as a reference image

You can store any image which has been acquired on an AXIOM Artis system and is being currently displayed (acquisition or fluoroscopic image, even during fluoroscopy) as a reference image.

It is not possible to store a **Store Monitor** image as reference image.

At the system console

- Stop the scene loop by clicking on the image with the mouse.

- Click on this icon (of the required plane).

At the touchscreen control

- Stop the scene loop by briefly tilting the IS joystick to the side.

- Activate the required plane.

- Press a **selection button** ("fire button") on the top or rear of the joystick.

  – The image is stored as the new reference image.
  – If the system is equipped with a reference image monitor, the image is immediately displayed on this monitor.

Only the image of the *active plane* is stored in the corresponding plane.

Storing a CT/MR image as an XA reference image

You can also store an image of the same patient acquired in a different modality (CT, MR) as *XA reference image* and display it on the reference image monitor for comparisons.

This can be done only if the CT/MR image of the patient is in the local database.

CT/MR images in an image matrix of 512^2 or 1024^2 with 8/1012 bit color depth can be stored as reference images.
Images in a different image matrix cannot be imported.
Images of other modalities, e.g. ultrasound, are rejected with a message.

XA reference images are stored under the current acquisition patient, i.e. the patient data of the CT/MR examination, **Patient Name**, **Patient ID**, **Date of Birth** and **Sex** must match the data of the current acquisition patient.
If they do not match, you must correct the data.

Caution

Images of other modalities displayed for reference

The resulting images are no longer completely identical to the original images. Information of medical relevance may be lost.

- Images of other modalities displayed for reference should not be used for primary diagnosis. The image quality may not be sufficient.

At the system console (only)

- Have the image sent to you, or import it from the network or a data carrier, e.g. CD-R.
- Select the required CT/MR image in the **Patient Browser**.

- Click on this icon in the toolbar.

Or

- Select **Patient > Save as XA Ref** in the **Patient Browser** menu.
  - The CT/MR image is stored as (XA) reference image and can be called up in the scene directory of reference images.
  - XA reference images are stored in a separate series.

The **Save as XA Ref** function cannot be applied on an examination or series!

Display modes for fluoroscopy/roadmap and acquisition

The basic display modes are specified below:

Display modes for fluoroscopy

- Live FLUO/**LIH** (Live Fluoroscopy/**L**ast **I**mage **H**old)
  The last fluoroscopic/roadmap image is displayed on the live image monitor after completion of fluoroscopy.
  The reference image is displayed on the reference image monitor.
- **Overlay Ref**
  The (inverted) reference image is faded into the live/LIH fluoroscopic image.

Overlay Ref *is an alternative to conventional roadmap with the advantage that motion artifacts do not interfere as much as for roadmap.*

With **Overlay Ref** *the reference image is always inverted (regardless of the set acquisition mode, e.g. also with* CO_2*).*

Overlay Ref is not possible in the following cases:

- The reference image is from a different modality (e.g. CT, MR).
- The reference image was acquired with a different zoom format.
- The reference image has a different image matrix (e.g. 512^2 instead of 1024^2).

Overlay Ref is automatically deactivated if you select **Roadmap**.
If a roadmap program is selected, **Overlay Ref** cannot be selected.

Due to technical reasons it is not possible to store an **Overlay Ref** image.
If you do so, only the current fluoroscopy scene is stored.

Display modes for roadmap

- **Compare with: Live Image**
  During roadmap, the unsubtracted live fluoroscopy image is displayed on the reference image monitor.
- **Compare with: Ref. Image**
  During roadmap, the selected reference image is displayed on the reference image monitor.

Display modes for acquisition

- **MFH** = **M**ax. **F**ill **H**old
  At the end of acquisition, the Max Fill image is choosen from the scene and displayed.
- **Loop**
  A scene is replayed continuously. After the last image, the same scene starts again from the beginning.
- **Loop through all scenes**
  The stored scenes are replayed one after the other.
- **Toggle** (only for DYNAVISION or DR-DYNAVISION scenes)
  The scene is played continuously but, unlike Loop, the review direction is reversed after the last image (ping-pong effect).

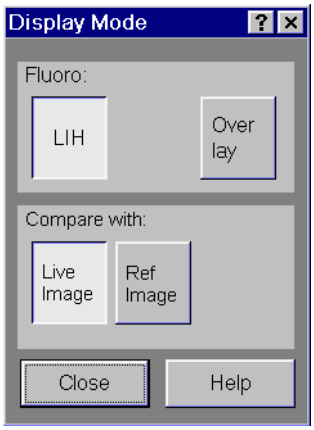
Selecting the display mode for fluoroscopy/roadmap

You can switch over the display mode during an examination:

Some display modes are available or not available depending on the monitor configuration of your system.

At the system console

◆ Click on the icon for display mode.
– A dialog box showing the available display modes appears.



❏ For display on the live image monitor during fluoroscopy

❏ For display on the reference image monitor(s) during roadmap

◆ Select the required display mode.

◆ Click on **Close**.

For biplane scenes, the display is always the same in both planes.

At the touchscreen control

Depending on the system configuration and the user profile selected, the display mode is selected in different ways.

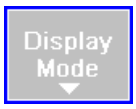
⇨ Chapter **Preparing the Examination - Fluoroscopy - Acquisition**, "Selecting a user profile"

Cardiac

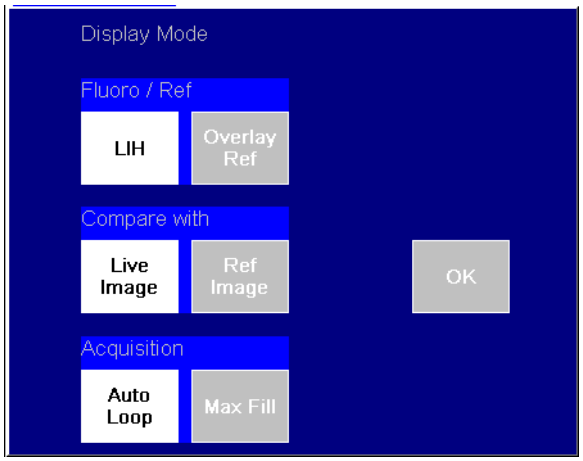
If the **Cardiac** profile is selected, you can select the available display modes in the **Exam** task card.

◆ Activate the required display mode.

Other profiles



◆ Activate **Display Mode** in the **Exam** task card.
– The available display modes are displayed.



❏ For display on the live image monitor during fluoroscopy

❏ For display on the reference image monitor(s) during roadmap

❏ For display on the live image monitor during acquisition

◆ Select the required display mode.
– The scene is displayed in accordance with your selection.

◆ Click on **OK** to close the window.

Selecting a reference image for use with Overlay Ref

You can use any "matching" Artis reference image for fading in to the fluoroscopc image / LIH which has been acquired in the same zoom stage, matrix size and patient position.

If a reference image has been acquired with a different zoom stage, matrix size or patient position or if it has a different modality (e.g. CT), **Overlay Ref** will not be performed. A plain fluoroscopic image will be displayed instead.

Storing reference images

⇨ "Storing reference images" on page 50

Selecting another refernce image

Reference images can be selected in the scene directory or via **Ref -** / **Ref +**.

⇨ Please refer to Part **Image Viewing and Image Processing**, Chapter **Managing and Viewing Scenes/Images**, "The scene directory of a patient"

Setting the degree of fading in with Overlay Ref

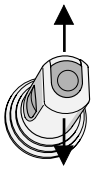
If **Overlay Ref** is active and a reference image has been stored, the reference image (inverted display) is superimposed on the current fluoroscopy image.

You can set the reference image portion to a value between 0% and 80%.

The default setting for the reference image portion is 10%.

At the touchscreen control (only)

You can use the IS joystick to change the degree of fading in of the reference image for the current and subsequent fluoroscopy runs.



◆ Tilt the IS joystick.
  – *Up*: The reference image will become clearer.
  – *Down*: The reference image will become less clear and the fluoroscopic image will become clearer.

The degree of fading in is shown in the lower right corner of the display, e.g. **OR: 10%**

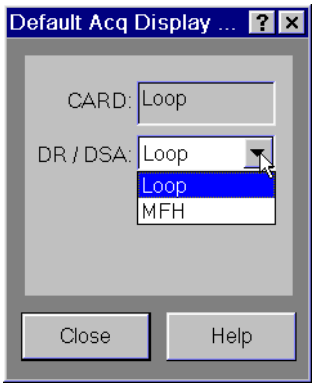
Defining the display mode for acquisition

After a scene has been acquired, it is first displayed as defined in the exam set.

You can set the default review mode separately for each acquisition mode.

At the system console (only)

- In the main menu, select **Acquisition > Acq Display Mode...** .
  – A dialog box with the available acquisition modes appears.



(depends on the configuration)

- Select the required review mode for the available acquisition modes.
- Confirm your selection by clicking on **Close**.
  – After acquisition, the scenes are replayed with the modes you have set.

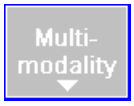
Selecting the image source for the additional color display

The additional color display can be used for displaying images from other equipment such as

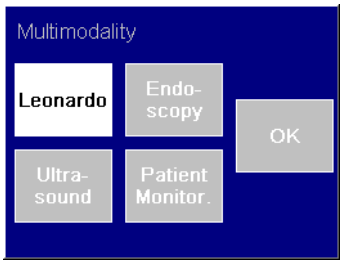
- ❏ LEONARDO / *syngo* Workplace
- ❏ Patient monitoring
- ❏ Ultrasound

etc.

At the touchscreen control



- ◆ Activate **Multimodality**.
  – A selection of available image sources appears.



Example

- ◆ Activate the required image source.
  – The image in the additional color display is switched over immediately.
- ◆ Activate **OK** to close the window.

At the system console (MMV control unit)

- ◆ Press the required button.
- ◆ Part **System Overview / Operating Elements**, Chapter **Operating Elements and Displays in the Examination Room**, "Multi Modality Viewing control unit"

Subtracted Fluoroscopy: Roadmap

Introduction

Roadmap is a special operating mode in which fluoroscopy images are subtracted from one another and displayed subtracted. During fluoroscopy an image is inverted (*mask*) and superimposed over all subsequent fluoroscopy images.

Roadmap makes catheter and guide wire positioning easier by emphasizing the vessels.

The mask is set automatically after the control stop. This normally occurs after the second image, but no later than after two seconds.

Roadmap is only possible if a DR or DSA acquisition program is selected.
If a PERIVISION or DYNAVISION acquistion program is selected, roadmap cannot be selected.
If a roadmap is selected, no PERIVISION or DYNAVISION can be selected.

To avoid motion artifacts caused by changing the position between subtracted images, the patient should not move during roadmap nor should the patient table or system be moved.

After roadmap has been selected, the roadmap program associated with a fluoroscopy program is automatically activated.

Roadmap phases

A roadmap examination comprises *three phases*:

Phase 1
- ❏ After you have selected roadmap, a fluoroscopy image is created. This image is used as the mask for subsequent fluoroscopy images.

Phase 2
- ❏ Switchover to subtracted display is automatic.
  Now contrast medium is injected to display the vessels.

Phase 3
- ❏ The vessel image is displayed subtracted.

Performing roadmap

Single plane roadmap

First phase (native)

At the touchscreen control

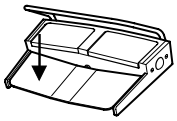
◆ Activate **Roadmap** in the **Exam** task card.

At the system console

◆ Click on the roadmap icon.

The message "Roadmap reset" appears on the data display.

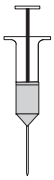
Fluoroscopy



◆ Actuate the **FLUORO pedal** and keep it pressed.
– After fluoroscopy has begun a normal fluoroscopy image is displayed briefly, then the display automatically switches to a subtracted image.
– In the status messages at the system console and on the data display, the note "Injection" is displayed.

Second phase (contrast medium injection)

◆ Keep the **FLUORO pedal** pressed.



◆ Now inject the contrast medium.
– In the fluoroscopy image you can now see the vessels in subtracted display as they are filled with contrast medium.

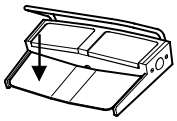
◆ Release the **FLUORO pedal** when the area to be examined is sufficiently filled with contrast medium.
– The last image of the second phase is displayed inverted (contrast medium white) and serves as the mask for subsequent fluoroscopic examinations.

The maximum contrast image can either be determined by releasing the FLUORO footswitch or reconstructed by the imaging system **Max Opac: yes** *(default).*

◆ Please ask Siemens Service, if you want to have **Max Opac: no**

Third phase (subtraction)

Fluoroscopy can be interrupted as often as required. The system remains in phase 3 and displays additional subtracted images each time the fluoroscopy switch is pressed.



◆ Press the fluoroscopy switch as often as required.
– You will see a fluoroscopy image from which the last filled image of phase 2 is subtracted.
– After you have released the fluoroscopy switch, the last image is retained and displayed (LIH).

Resetting roadmap

If motion artifacts arise, roadmap can be reset (new mask):

◆ Activate **Reset Rdmp A**.
– The roadmap process restarts.

Biplane roadmap (Artis dBC/dBA)

The roadmap mask image is created either

❏ *separately* for each plane

❏ or *simultaneously* for both planes

.

During phase 3 fluoroscopy can be performed alternately in each plane as often as required.

You can perform either fluoroscopy or roadmap: It is not possible to perform subtracted fluoroscopy in one plane and unsubtracted fluoroscopy in the other plane!

Selecting/deselecting roadmap

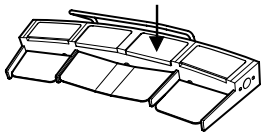
At the touchscreen control

◆ Activate **Roadmap** in the **Exam** task card.

At the system console

◆ Click on the roadmap icon.

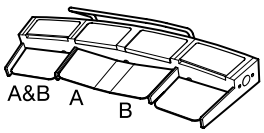
With the footswitch



◆ Press the **RDMP ON/OFF pedal** for longer than 2 seconds.

– The reset possibilities are displayed.

Roadmap



◆ Operate the corresponding **FLUORO pedal**.

⇨ Perform roadmap as described under “Single plane roadmap” on page 60.

Resetting roadmap

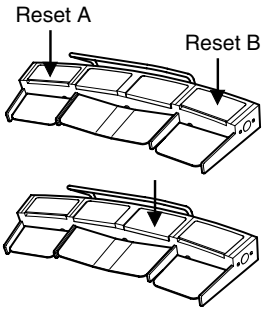
Roadmap can be reset separately for each plane:

Reset A
❏ resets roadmap for plane A;
a new roadmap mask image must be created for plane A.

Reset B
❏ resets roadmap for plane B;
a new roadmap mask image must be created for plane B.

Reset A + B
❏ resets roadmap for both planes;
roadmap can be restarted.

With the footswitch



◆ Press the **Reset A** or **Reset B pedal**.
– Plane A or plane B will be reset.

Or

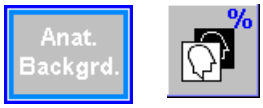
◆ Briefly press the **RDMP ON/OFF pedal**.
– Plane A and plane B will be reset.

At the touchscreen control

◆ Activate **Reset Rdmp**.

Anatomical background with roadmap

During an active subtracted fluoroscopy (roadmap phase 3) the anatomical background (landmark) can be added to the subtraction image using the joystick control.



If the last fluoroscopy image (LIH) is displayed on the monitor during roadmap, the anatomical background can be adjusted by selecting **Anat. Backgrd.** (task card **PostProc**).

- ◆ Set the background you require.

⇨ Part **Image Viewing and Image Processing**, Chapter **DSA Postprocessing**, "Fading in anatomical background"

Operator Manual
Image Viewing and Image Processing

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The system for angiographic examinations provides you with a series of postprocessing functions for diagnosis and evaluation.

The task card PostProc

You can perform postprocessing at the system console in the control room. Certain functions can also be executed on the touchscreen control in the examination room.

At the monitor of the system console in the control room

Single plane system

In case of a single plane system, the control area is located on the right.

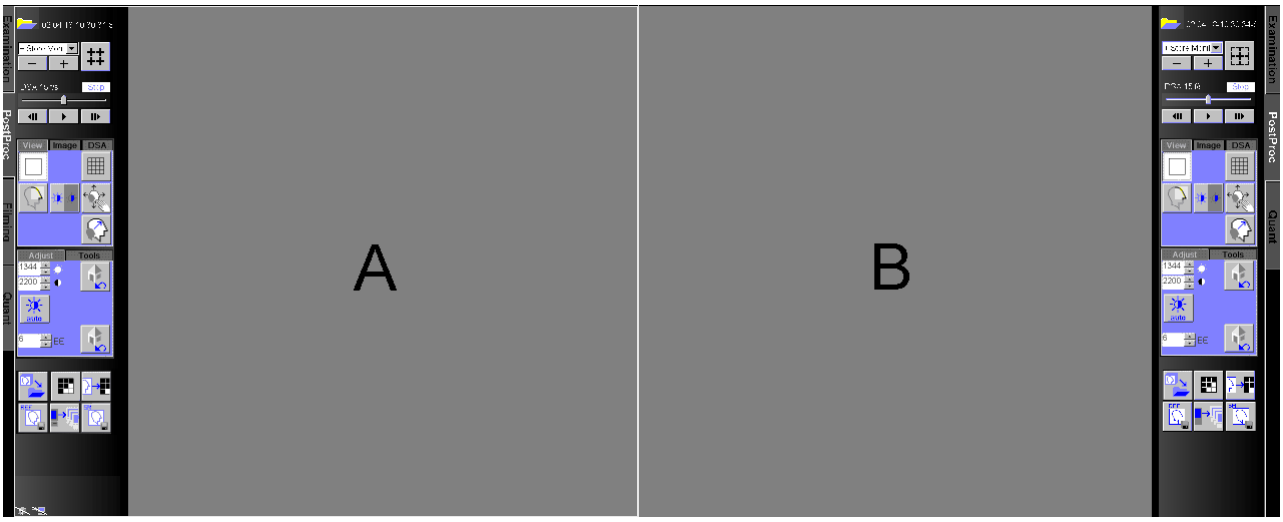
Full screen display on the task card **PostProc**

(1) Image area

(2) Control area

Biplane system On systems with two acquisition planes, you will find the control area:

- ❏ on the left or right for plane A (floor stand)
- ❏ on the right for plane B (top stand)



Example

Processing the other plane

- ◆ Move the mouse pointer from one monitor to the other.

Text information in images

In images various information is displayed as image text. This text information identifies the patient and documents examination and image parameters.

Not all information is displayed in all images.
The text information depends on the configuration in service mode.

In full screen mode

Image texts are grouped by content and displayed in the four corners and along the bottom edges of each image.

Example

(1) Patient and examination data

(2) Exposure parameters

(3) Room for message line and ECG display[1]

(4) Image parameters

(5) System-specific information

[1] with cardiac systems only

Patient and examination data

Image text	Abbreviation	Example
Patient name	-	Peter Patient
Patient ID	-	123
Date of birth	-	*06/01/62
Study number	-	STUDY1
Acquisition date	-	11.8.2003
Acquisition time	-	10:08:32 AM
Scene and image number/ total number of images or number of frames (center image)	-	1002 - 9/38
Mask number	-	M 4
Scene time	-	4.00 s

Exposure parameters

Image text	Abbreviation	Example
Quality factor (only if the image is compressed with loss)	CQ	CQ 40
Exam set	-	Renalis
Zoom	-	cm 20
Plane for images of biplane systems		A
Plane A	A	
Plane B	B	
Tube voltage	kV	kV 82
Tube current	mA	mA 708
Dose (in nGy per image)	D	D 421
Angulation RAO-LAO / CRAN-CAUD	-	RAO 7° / 0°

If a question mark (?) appears instead of a value, no value is available for this parameter.

System-specific information

Image text	Abbreviation	Example
Institution	-	Room 3
Manufacturer's model name	-	AXIOM Artis
Program version	-	VB30B
Patient position		HFS
Head first	H	
Feet first	F	
Left lateral	L	
Right lateral	R	
Supine position	S	
Prone position	P	
Work status of scene		//////R

Image parameters

Image text	Abbreviation	Example
Image matrix	-	950x1240
Opacification	OPAC	OPAC
Edge enhancement filter	EE	EE 10%
Dynamic density optimization (harmonization)	DDO	DDO 10%
Anatomical background (landmark)	AB	AB 0%
Overlay Ref	OR	OR 10%
Pixelshift (x,y)	-	x/y -2.4/-6.1
Window center (native)	WC	WC 123
Brightness (subtracted)	WB	WB 143
Window width (native)	WW	WW 2809
Contrast (subtracted)	WC	WC 43

With the exception of the patient name and the patient ID number, you can configure which texts are displayed.

- Call up the **Configuration Panel** via **Options > Configuration** and then double-click **Image Text Editor**.

In the scene/image directory

In the overview mode (scene directory of a patient, image directory of a scene) some selected text is displayed for each scene / each (reference) image.

Example

Image text	Example
Image number	3
Angulation	RAO: 0 CRA: 0
Acquisition mode	DSA
Acquisition plane	A
Work status of scene	/////R/

At the touchscreen control in the examination room

You can select several postprocessing functions on the **PostProc** task card and perform them with the touchscreen joystick.

⇨ Part **System Operation**, Chapter **Operation via Touchscreen Control**

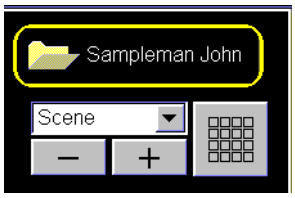
The selection of available functions depends on system configuration and selected profile.

Starting postprocessing

Before you can start postprocessing, you select the patient using the **Patient Browser** and load him into the **PostProc** task card.

If you want to postprocess images which are stored on an archive medium, you must first copy the data to the **Local Database**.

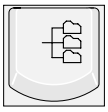
Active patient



The name of the *active postprocessing patient* is displayed at the top of the control area next to the folder icon.

If no patient is selected, the folder icon appears closed and the image area is dark.

Calling up the Patient Browser

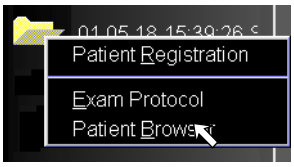


- Press the patient browser key (**Num .**) on the symbol keypad.

Or:

- From the main menu, select **Patient > Browser...** .

Or:



- Click on the folder icon with the right mouse button.
- Select **Patient Browser** from the popup menu.

The **Patient Browser** is displayed.

⇨ For more information on the **Patient Browser**, please refer to the *syngo* ® documentation.

Loading a scene/image

You can load and view any scenes/images which are stored in the local database of your system and which have one of the following formats:

- ❏ X-ray images (XA only) up to 2048^2 with depth 8/10/12 bits
- ❏ CT images in 512^2 and 1024^2 with depth 8/10/12 bits
- ❏ MR images in 512^2 and 1024^2 with depth 8/10/12 bits

From the following systems:

- ❏ AXIOM Artis or other *syngo* ® systems
- ❏ HICOR T.O.P.
- ❏ POLYTRON T.O.P. (including PERIVISION and DYNAVISION scenes)
- ❏ DICOM compliant images from systems of other vendors

- ◆ Select the required patient, the required study/series/scene (images) in the **Patient Browser** and load them by drag & drop or by double-clicking.
  – The scene/image is loaded as a full screen and displayed in accordance with the stored settings (e.g. in a loop).

⇨ For more information on loading data using the **Patient Browser**, please refer to the *syngo* ® documentation.

Searching for and importing data in the Network

Using the **Patient Search**, you can query and retrieve patient and examination data from workstations and long-term archives that are working with other DICOM program systems or older *syngo* ® program versions and are therefore not displayed in the navigation area of the **Patient Browser**.

- ◆ Click on this icon in the toolbar.

Or

- ◆ Select **Patient > Search...** from the menu of the **Patient Browser**.

The **Patient Search** window is displayed.

- ◆ Enter your search criteria and click on **Search**.

⇨ For more information on searching using the **Patient Browser**, please refer to the *syngo* ® documentation.

Changing patient data

It is not possible to correct or rearrange patient data in the following cases:

- ❏ Data is protected
- ❏ Data of HIS/RIS patients
- ❏ Data of the current examination patient during radiation
- ❏ Data which is currently used by other applications
- ❏ Data on external media

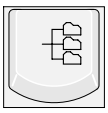
Corrections depend on the selected level: **Patient** - **Study** - **Series** - **Instance**
Only those data can be modified which refer to the selected level. To modify the name of the series (scene name), for example, the **Series** level must be selected.
Studies which include only one scene should be corrected on the **Instance** level.

If you correct the patient position, all orientation marks and angulation data are changed accordingly in the images.

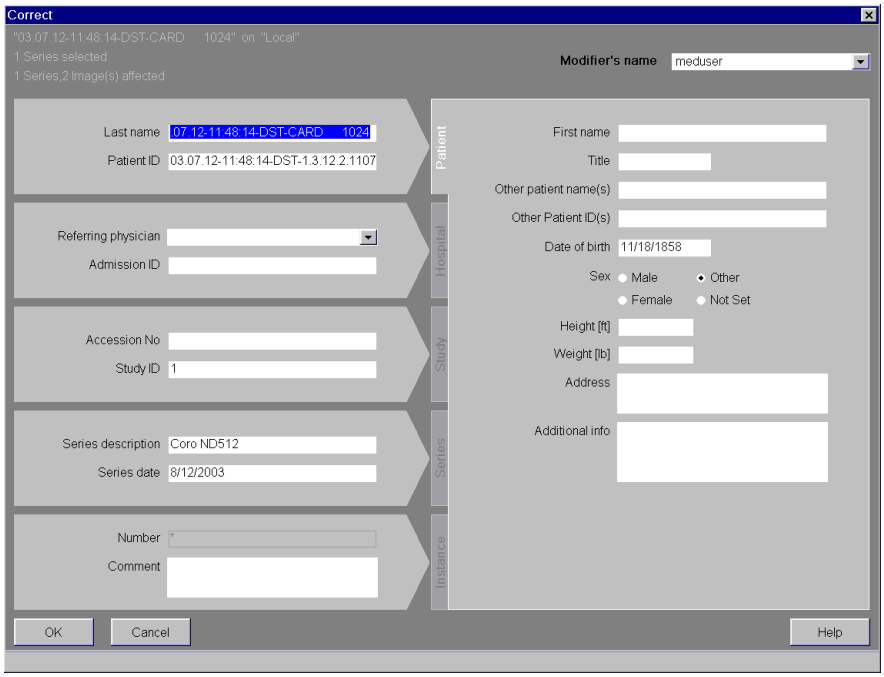
Renaming/correcting an emergency patient

- ◆ Select **Edit > Correct** in the main menu of the **PostProc** task card.

Or



- ◆ Call up the **Patient Browser**.
- ◆ Select the patient entry, the study/series/scene.
- ◆ Select **Edit > Correct** in the menu of the **Patient Browser**.
  – The **Correct** window is displayed.



- Enter the correct patient data.

Caution

Position angles are not recalculated when correcting the patient position in the **Correct** window.

Risk of wrong diagnosis, treatment of the wrong side.

- Do *not* base the left/right orientation on the position angles after the patient position has been changed in the **Correct** window.

- Change other data, if necessary.

- Enter your name under **Modifier's name** or select your name from the selection list.[1]
- Confirm by clicking on **OK**.

⇨ For more information on **Correcting and Rearranging**, please refer to the *syngo* ® documentation.

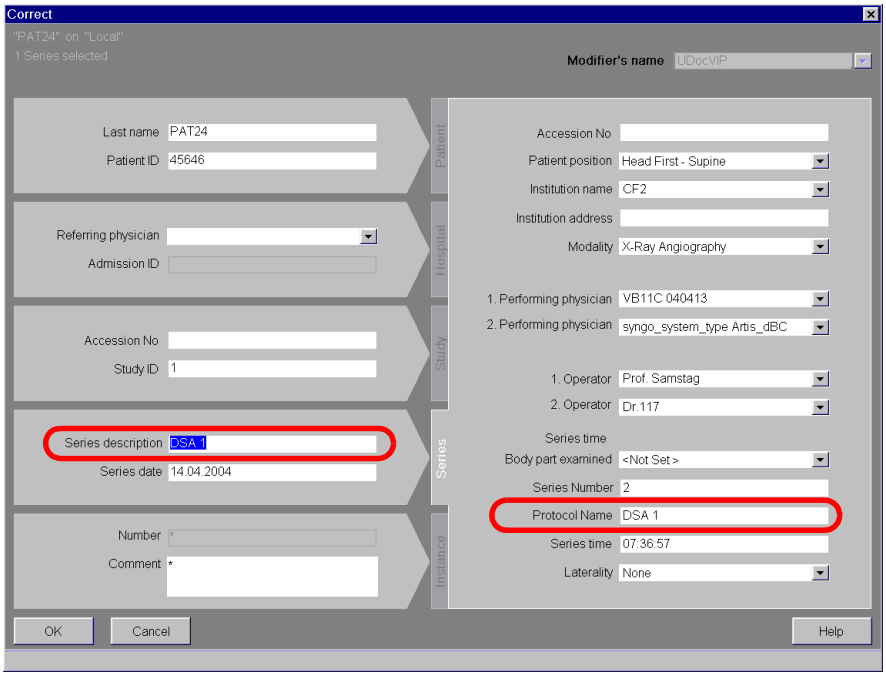
[1] only necessary if security is not enabled

Changing the name of a series

You can change an automatically assigned name of a series (scene name).

When changing the name of a series, *you must always change both* **Series description** *and* **Protocol Name**.
This is, because different network software may use either the **Series description** or the **Protocol Name** from the DICOM header.

- Select **Edit > Correct** in the main menu of the **PostProc** task card.
  – The **Correct** window with the **Series** subtask card on top is displayed.



- Overwrite the text in the **Series description** input field as required.
- Mark the just entered text.
- Press **Ctrl** + **C** on the keyboard (copy).
- Mark the old text in the **Protocol Name** input field.
- Press **Ctrl** + **V** on the keyboard (paste).
- Confirm by clicking on **OK**.

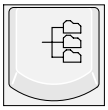
Moving series/scenes/images accidentally acquired under the wrong patient

Rearrange is not possible in the following cases:

❏ Rearrange to the wrong data level

❏ Rearrange scenes/images to a series acquired with another patient position

❏ When images were acquired on a different modality (e.g. CT)



◆ Call up the **Patient Browser**.

◆ Select the series/scenes (images).

Caution

Assignment of series/scenes/images to the wrong patient

Risk that diagnostic data could not be found
Danger of incorrect diagnoses due to allocation of data to wrong patient

◆ Move data carefully.

Warning

Merging images with different patient position, patient orientation or laterality of a patient.

Patient orientation and laterality information may be wrong.

◆ Do *not* merge data with different patient position, patient orientation and laterality information.

Drag & Drop

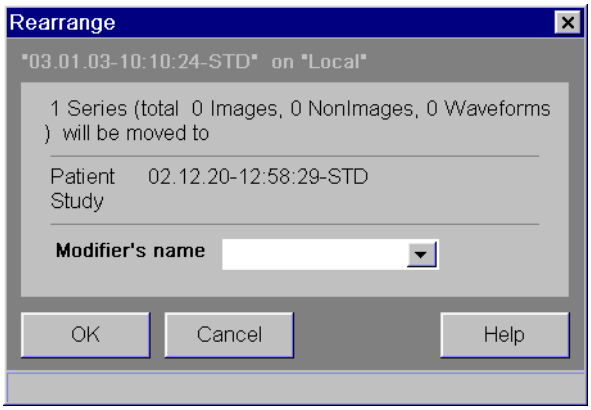
◆ Drag the selected data to the target position and release the mouse button.

Cut & Paste

- Click on this icon or call up **Edit > Cut** from the menu of the **Patient Browser**.
- Click on the target position.

- Click on this icon or call up **Edit > Paste** from the menu of the **Patient Browser**.

The **Rearrange** dialog box will be displayed.

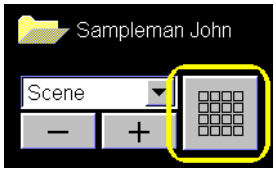


- Enter your name under **Modifier's name** or select your name from the selection list.
- Confirm by clicking on **OK**.

⇨ For more information on **Correcting and Rearranging**, please refer to the *syngo* ® documentation.

The scene directory of a patient

Once you have selected a patient, you can call up an overview display of the stored scenes/images/reference images as described below:



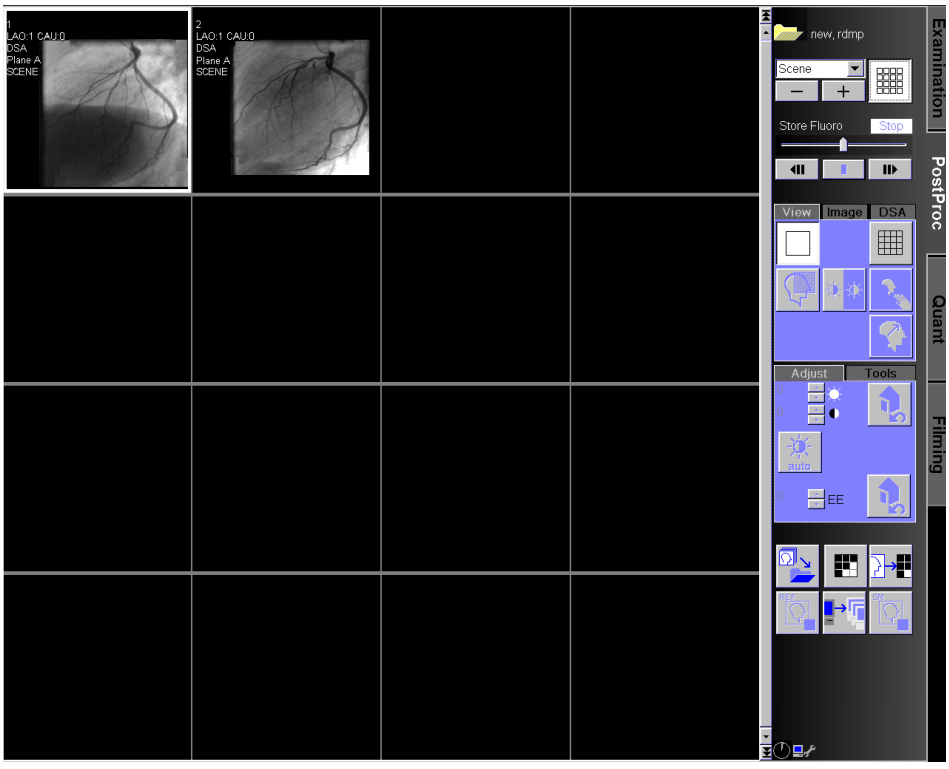
At the system console

- Click on this icon.

At the touchscreen control

- Activate **Dir**.

The system switches to 4x4 display mode and displays the representative image of each stored scene.



Scene directory

Representative

A scene is *represented* by a specific image in the overview display.

Native

❑ This is the center image for native scenes.

Subtracted

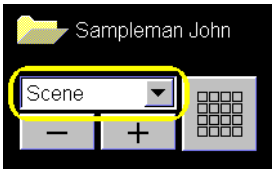
❑ This is an image with maximum fill (*Max Fill image*) in DSA scenes.

⇨ "Replacing the maximum fill image" on page 29

Limiting display to scenes/images/reference images

To make selecting a scene/image easier, you can limit what the system displays.

At the system console



You have the following choice:

❑ **Scene**: only scenes[1] (acquisitions and fluoroscopy)

❑ **Ref. Image**: only reference images[2]

❑ **Store Monitor**: only stored images

❑ **+ Ref. Image**: scenes and reference images[2]

❑ **+ Store Monitor**: scenes and stored images (no reference images)

◆ Pick the required display from the selection list.
– Only the selected types are displayed in the scene directory.
– Types other than those selected are skipped when scrolling through the full-screen display.

At the touchscreen control

At the touchscreen control you can switch between scenes and reference images.

◆ Activate **Ref Dir**.
– Only reference images are displayed.

[1] multiframes
[2] On systems with reference image monitor(s), reference images are displayed only on the reference image monitor in full-screen format.

Scrolling through the directories

If more than 16 scenes/images/reference images are stored in the examination of a patient, it might not be possible to display all of them simultaneously.

In that case, you can page through the overview display.

At the system console

- Use the scroll bar:

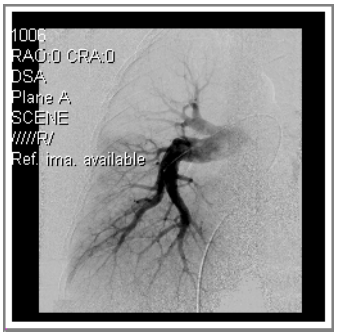
Or

- Press the **Page Up** or **Page Down** key on the keyboard.

At the touchscreen control

- Tilt the IS joystick.
  – After the first or last row, the next row is taken into the selection.

Selecting scenes/(reference) images

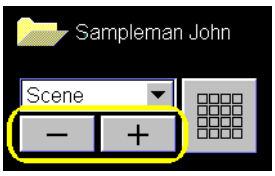


If a scene / (reference) image is selected in the overview display, it is marked with a light border. This scene / image is shown in the full-screen display when you switch back to it.

Changing the selection

At the system console

- Click (with the left mouse button) on the required scene.
  – The selected scene is displayed with a thick border.



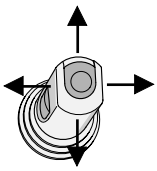
Or

- Click on the **-** or **+** button.

Or

- Use the arrow keys ←, ↑, ↓, → on the keyboard.

At the touchscreen control



- Tilt the IS joystick.

Selecting more than one scene

At the system console

You can select more than one scene at a time (e.g. for filming/sending).

All scenes

- Click on the first scene, press the **Shift** key, scroll to the last scene, and click on it.

⇨ "Scrolling through the directories" on page 21

A series of scenes

- Click on the first scene, press the **Ctrl** key, and click on further scenes.

The selected scenes are marked with a light border.

Selecting a scene/(reference) image

At the system console

- Double-click on the required image.
  – The scene / image is selected and displayed as full screen.

Or

- Click on the icon for overview display.
  – The system switches to full-screen display and shows the scene/(reference) image last selected.

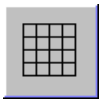
At the touchscreen control

- Press a **selection button** ("fire button") on the top or rear of the joystick.
  – The system switches to full-screen display and shows the scene/(reference) image last selected.

The image directory of a scene

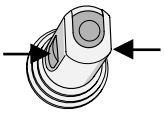
If you have selected a scene, you can obtain an overview of the images of this scene.

At the system console



- Click on the 4x4 icon on the **View** subtask card.

At the touchscreen control



- Press one or both **function buttons** on the side of the joystick.

The system switches to 4x4 display mode and shows the images of the scene with reduced resolution.

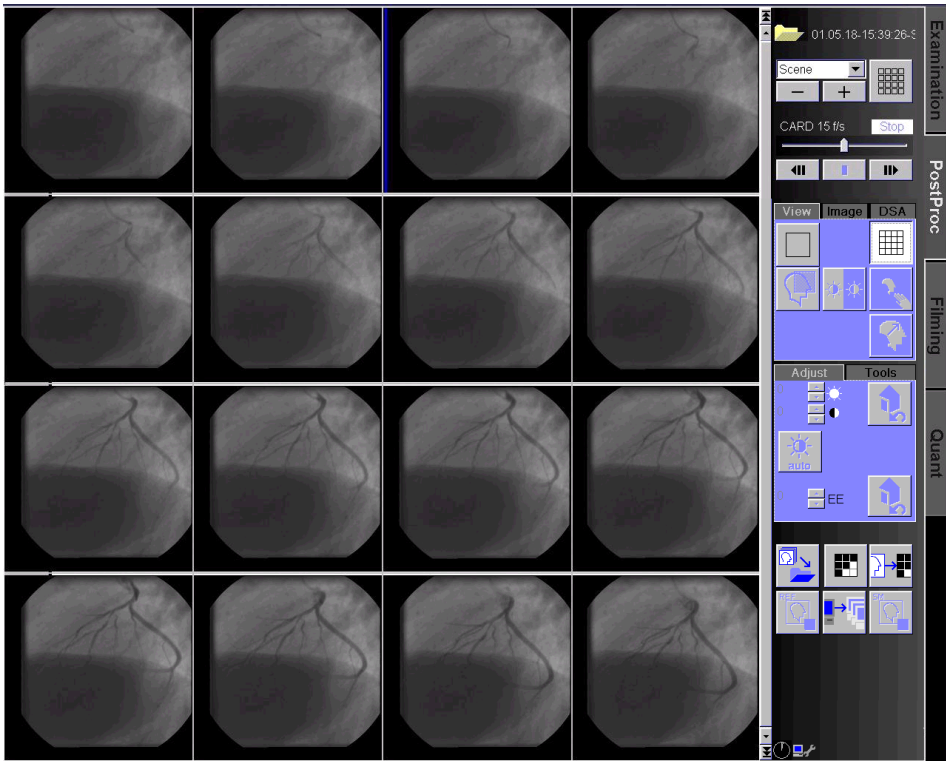


Image overview of a scene

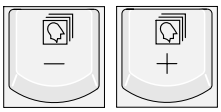
Viewing scenes/images

Scrolling through scenes/(reference) images

At the system console

◆ Click on the **-** or **+** button.

Or



◆ Press the **Scene -** (**Num 4**) or **Scene +** (**Num 5**) buttons.

At the touchscreen control

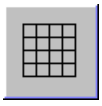
◆ Activate **Scene -/+** or **Ref -/+**.

Displaying a scene as single images

Just as you have obtained an overview of *various* scenes/images of a patient, you can also have the images of *a single* scene displayed.

At the system console

◆ Select a *scene*.



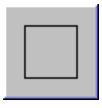
◆ Click on the icon for overview mode on the **View** subtask card.
– The system switches to 4x4 display mode and displays the images of the scene.

Selecting an image and switching to full-screen display

◆ Double-click on the required image.
– The image is selected and displayed full screen.

Or

◆ Click on the required image.



◆ Click on the icon for full-screen mode on the **View** subtask card.
– The system switches to full-screen display and displays the image which was last selected in the scene.

At the touchscreen control

- Press a **selection button** ("fire button") on the top or rear of the joystick.

Controlling scene review (Loop)

You can review scenes at the same rate as they were acquired or you can slow down or speed up scene review depending on the rate of acquisition and system configuration.

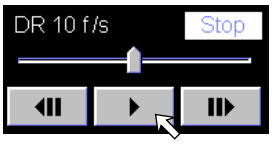
After you have called up a scene, it is first displayed as preset: with the max fill image or in a loop.

⇨ "Defining the default setting for dynamic image display for review" on page 28

You can stop a scene at any time, scroll forward or backward by one image, or resume reviewing.

Starting Loop

At the system console

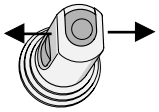


- Click on the review button.

Or

- Click into the image area and hold the mouse button pressed for a moment.
  – The images are displayed in a loop (or in toggle display in the case of DYNAVISION).

At the touchscreen control



◆ Tilt the IS joystick.
– *Left*: the scene runs *backward*
– *Right*: the scene runs *forward*

The reviewing speed depends on how far you tilt the joystick.

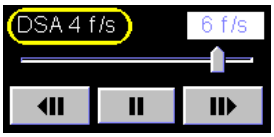
If the joystick is held in its final position for more than two seconds, scene review is speeded up to its maximum possible speed.

If you release the joystick, the scene runs at acquisition speed again.

Setting the review rate

At the system console

Acquisition rate



The acquisition rate of the scene is displayed on the top left corner.

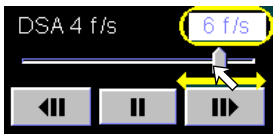
Depending on the acquisition mode, you can control the review rate with the slider:

❑ Slider to the *right*: the scene is reviewed *forward*

❑ Slider in *center position*: the scene is *stopped*

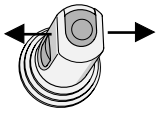
❑ Slider to the *left*: the scene is reviewed *backward*

The maximum review rate is double the acquisition rate.



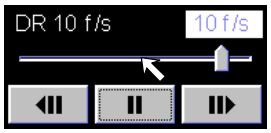
◆ Click and drag the slider to the required position.
– The scene is replayed immediately at the new rate.
– The current rate is displayed on the top right corner.

At the touchscreen control



◆ Tilt the IS joystick.
– The further left or right the joystick is tilted, the faster the scene will be played back.

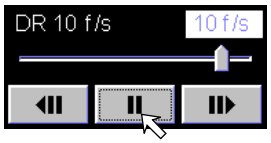
Step by step **At the system console**



◆ Click on the bar of the slider.
– Every time you click on it, the rate is changed by one step.

Stopping Loop

At the system console

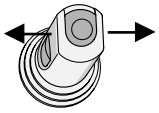


◆ Click on the stop button.
– The scene is stopped at the last displayed image.

Or

◆ Click into the image area (with the left mouse button).

At the touchscreen control



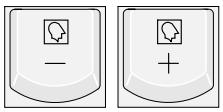
◆ Tilt the IS joystick briefly.

Single step

At the system console

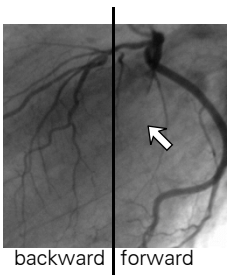
◆ Click on a single step button.
– A running scene is stopped at the last frame displayed and switched backward or forward by one frame.
– A stopped scene is switched forward or backward by one frame.

Or

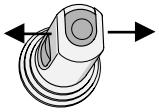


◆ Press the **Image -** (**Num 1**) or **Image +** (**Num 2**) button.

Or



◆ Click into the image area.
– If you click into the *left* half of the image, the scene is stopped. With the next click, the *previous* frame is displayed.
– If you click into the *right* half of the image, the scene is stopped. With the next click, the *next* frame is displayed.



At the touchscreen control

- Tilt the IS joystick briefly.
  – The loop stops.
- Tilt the IS joystick briefly.
  – *Left*: one image *backward*
  – *Right*: one image *forward*

Defining the default setting for dynamic image display for review

After a scene has been acquired, it is first displayed as defined in the exam set.

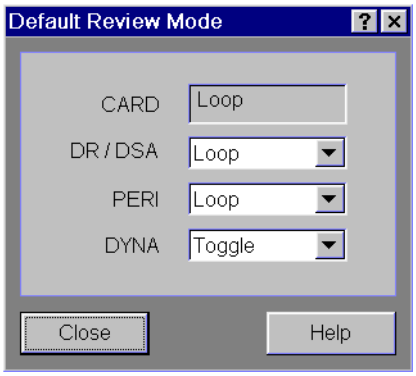
Dynamic image displays

- ❑ **MFH** = **M**ax. **F**ill **H**old
  A scene starts running and stops at the maximum fill image.
- ❑ **Loop**
  A scene is replayed continuously. After the last image, the same scene starts again from the beginning.
- ❑ **Toggle** (only for DYNAVISION scenes)
  The scene is played continuously but, unlike Loop, the review direction is reversed after the last image (ping-pong effect).

At the system console (only)

You can set the default review mode separately for each acquisition mode.

- In the main menu, select **View > Review Mode** .
  – A dialog box appears with the available review modes.



- Select the required review mode for the available acquisition modes.
- Confirm your selection by clicking on **Close**.
  – After acquisition, the scenes are replayed with the modes you have set.

Loop through all scenes

You can set the review in such a way that the scenes are replayed one after the other during full-screen display.

Loop

At the system console

- Select **View > Loop All Scenes** from the main menu.
  – The next time you select the menu, this item will be marked with a check-mark.

At the touchscreen control

- Activate **Loop Scenes** on the **Exam** or **PostProc** task card.

After the end of the first scene, the second scene is replayed, etc.

Replacing the maximum fill image

During acquisition, the acquisition system automatically selects the "maximum" fill image (**Max Fill**) or "minimum" fill image in the case of CO_2 DSA. This image is used as *scene representative*, that is, it is displayed in the scene directory.

If you want to use an image other than the automatically chosen image as scene representative, you can replace it as described below:

At the system console

- Select **Image > Max. Fill Override** from the main menu.

At the touchscreen control

- Activate **Max Fill New** on the **PostProc** task card.

The currently displayed image is selected as the new scene representative.

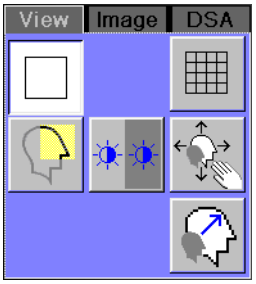
In biplane scenes, the maximum fill image is always replaced simultaneously for both planes.

Selecting scene/image display

At the system console

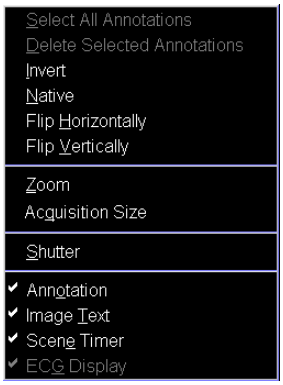
On the **View** and **Image** subtask cards, in the **View** and **Image** menu, and in the popup menu (right mouse button in the image), you will find the tools for changing the display of a scene/(reference) image.

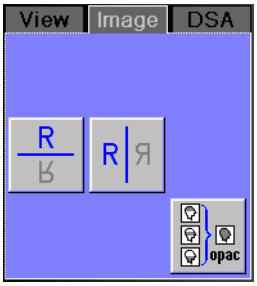
Subtask card



Main menu

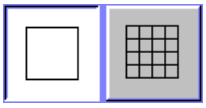
Popup menu





(depends on the configuration)

◆ If necessary, click the **View** or **Image** subtask card into the foreground.



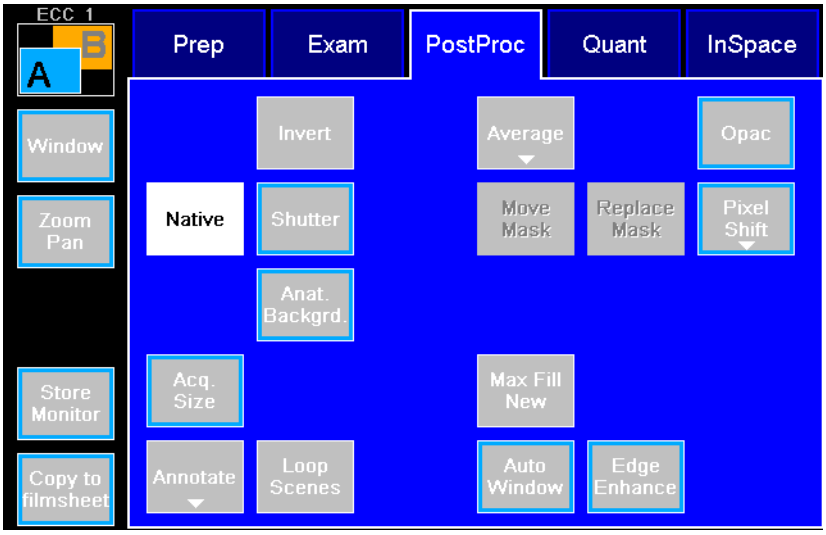
⇨ "Displaying a scene as single images" on page 24

⇨ Chapter **Image Postprocessing**, "Flipping an image"

⇨ Chapter **DSA Postprocessing**, "Generating the image with maximum contrast medium filling"

At the touchscreen control

System functions for image viewing and processing are located at the left margin of the touch screen control and also under the dedicated **PostProc** tab card.



Example

Setting an electronic shutter

If you want to hide unimportant details outside the center of the image, you can set an electronic shutter. This is done on an enlarged image in the same way as on an unzoomed image.

Please observe, that some image review stations cannot correctly interprete the electronic shutter.

- Open the electronic shutter completely before sending images.

If the shutter function is used with an image that was acquired with a polygonal shutter, the polygonal shutter is removed and replaced with a rectangular shutter.
The polygonal shutter will no longer appear when the function is deselected.

For biplane scenes, this function is performed only in the active plane.

Switching on shutter

At the system console

- Click on this icon.

Or

- Select **View > Shutter** from the main menu or **Shutter** from the popup menu.

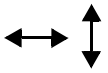
At the touchscreen control

- Activate **Shutter**.

The electronic shutters are drawn in the image.

Setting the shutter

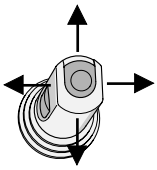
At the system console



- Move the mouse pointer to the horizontal or vertical shutter edge.
  – The mouse pointer changes shape.
- Drag the shutter open or closed.
  – The entire scene / the image is displayed symmetrically to the image center.

The shutter position is stored with the scene for subsequent reviews.

At the touchscreen control



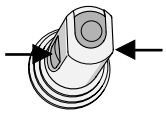
- Tilt the IS joystick.
  – *Left*: the left and right shutters are *opened* symmetrically.
  – *Right*: the left and right shutters are *closed* symmetrically.
  – *Up*: the upper and lower shutters are *opened* symmetrically.
  – *Down*: the upper and lower shutters are *closed* symmetrically.

Panning the image

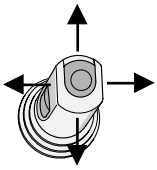
At the system console

- Press and hold the **Shift** key.
- Click and drag the image behind the shutter.

At the touchscreen control



- Press one or both **function buttons** on the side of the joystick and keep the button(s) pressed.
  – The mouse pointer changes shape.



- Tilt the IS joystick.
  – The image moves in the corresponding direction.

Switching off shutter

At the system console

- Click on this icon.

Or

- Deselect **View > Shutter** from the main menu or **Shutter** from the popup menu.

At the touchscreen control

- Deactivate **Shutter**.

The shutters disappear from the image.

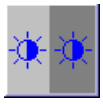
Inverting grayscale values

You can invert the gray scale of an image / a scene, that is, black becomes white and white becomes black.

The blanking circle and the electronic shutters will always be shown in black, regardless of inversion.

For biplane scenes, this function is always performed simultaneously in both planes.

At the system console



- Click on this icon.

Or

- Select **Image > Invert Gray Scale** from the main menu or **Invert Gray Scale** from the popup menu.

At the touchscreen control

- Activate **Invert**.

The gray scale of the entire scene/image is inverted (black and white reversal).

Magnifying the scene/image, zooming/panning

If you want to see image details more clearly, you can magnify the scene/image and then move the detail of interest to the image center.

Depending on image matrix of the current scene/image, different zoom functions are available:

❏ Zoom by a factor of 2

❏ Zoom to acquisition size (1:1 pixel display)

For biplane scenes, zooming is always performed simultaneously in both planes. Panning, however, is performed only in one plane.

Switching on zoom

At the system console

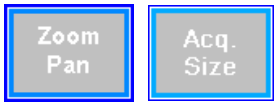
◆ Click on the required icon.

Or

◆ Select **View > Zoom** / **Acquisition Size** from the main menu or **Zoom** / **Acquisition Size** from the popup menu.
– The next time you select the menu, this item will be marked with a check-mark.

If Zoom is active, you cannot scroll through or stop the scene with a mouse click in the image area.

At the touchscreen control



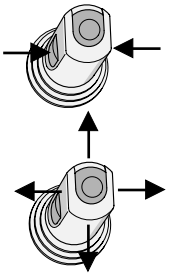
◆ Activate **Zoom Pan** or **Acq. Size**.

Panning the image

At the system console

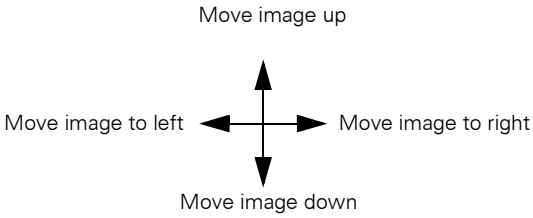
- Move the mouse pointer into the image.
- Click and drag in the image area.

At the touchscreen control



- Press one or both **function buttons** on the side of the joystick and keep the button(s) pressed.
- Tilt the IS joystick.

The image is moved simultaneously.



If you set an electronic shutter and then zoom the image, the shutter remains at the same position. You are therefore panning the image behind the shutter.

Normally the zoom value is not stored with the image.

If you want to do that nevertheless, e.g. for pediatric applications:

- Select **Image > Max. Fill Override** from the main menu or activate **Max Fill New** on the touchscreen console.

Using the pointer

When you are working at the console in the control/examination room, your mouse pointer will normally not be displayed on the monitor in the other room.

If you want to point out a certain image detail to someone in the examination/control room, you can also display the mouse pointer on the monitor in the other room:

Pointer on **At the system console or at the touchscreen control**

◆ Click on this icon on the **Tools** subtask card.

The mouse pointer changes its shape and is displayed on the monitor in the other room.

Pointer off

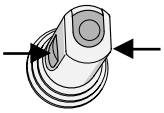
◆ Click on the pointer icon again.

Or

◆ Click on the image.

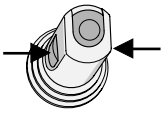
Now the mouse pointer is displayed only on your monitor.

Pointer on/off **At the touchscreen control**



◆ Press one or both of the **function buttons** on the side.
– The pointer is hidden or displayed.

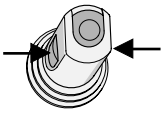
Pointer on and position



◆ Press one or both side **function buttons**, hold them pressed, and tilt the IS joystick.
– The pointer is displayed (also in the control room) and moves.

◆ Release the **function button(s)**.
– The pointer stays put; you can carry on working normally.

Pointer off



◆ Press one or both of the **function buttons** on the side.
– The pointer is deactivated.

Switching ECG display on/off

For scenes acquired with an ECG, you can activate or deactivate the ECG display.

ECG display on

At the system console

- Select **View > ECG Display** from the main menu or **ECG Display** from the popup menu.

At the touchscreen control

- Activate **Display ECG**.

The ECG appears at the bottom of the image area.

ECG display off

At the system console

- Deselect **View > ECG Display** from the main menu or **ECG Display** from the popup menu.

At the touchscreen control

- Deactivate **Display ECG**.

The ECG disappears.

Switching image text on/off

You can temporarily switch the image text display off and then switch it on again.

Image text off

At the system console (only)

- Deselect **View > Image Text** from the main menu or **Image Text** from the popup menu.

The image text is hidden *(except for the patient´s name and ID)*.

Image text on

At the system console (only)

- Select **View > Image Text** from the main menu or **Image Text** from the pop-up menu.

If you do not want certain text to be displayed, you can configure every single text entry (with the exception of the patient name and patient ID) with the help of the **Image Text Editor** in the Configuration Panel (**Options > Configuration** in the main menu.

Switching scene time display on/off

The scene time is the current run time of the acquisition scene from the beginning of the scene. You can switch this time display on or off.

Switching on time display

At the system console (only)

- Select **View > Scene Timer** from the main menu or **Scene Timer** from the popup menu.

The scene time is displayed on the top left corner.

Switching off time display

At the system console (only)

- Deselect **View > Scene Timer** from the main menu or **Scene Timer** from the popup menu.

Introduction

You can perform the following postprocessing functions on the **PostProc** task card:

Image display/ Image processing

- ❏ Window values
  Adapting the digitally stored grayscale values to the visual acuity of the human eye. (Setting "brightness" and "contrast")
- ❏ Edge enhancement filter
  Emphasizing details
- ❏ Horizontal/vertical image flip
- ❏ Averaging
  Reducing noise by averaging several images of a scene.

Graphics

- ❏ Image annotation (annotations)
  Entering predefined or new text in the image
- ❏ Circle
  Emphasizing image details with a circle
- ❏ Line/polygon
  Marking image details with lines and polygons
- ❏ Arrow
  Emphasizing image details with an arrow

Measurement

- ❏ Distance line
  Drawing and measuring distances
- ❏ Angle
  Drawing and measuring angles

Defining window and filter values

Information about windowing

With contrast and brightness windowing you can adapt the image to display the gray scale region of interest with optimal contrast conditions.

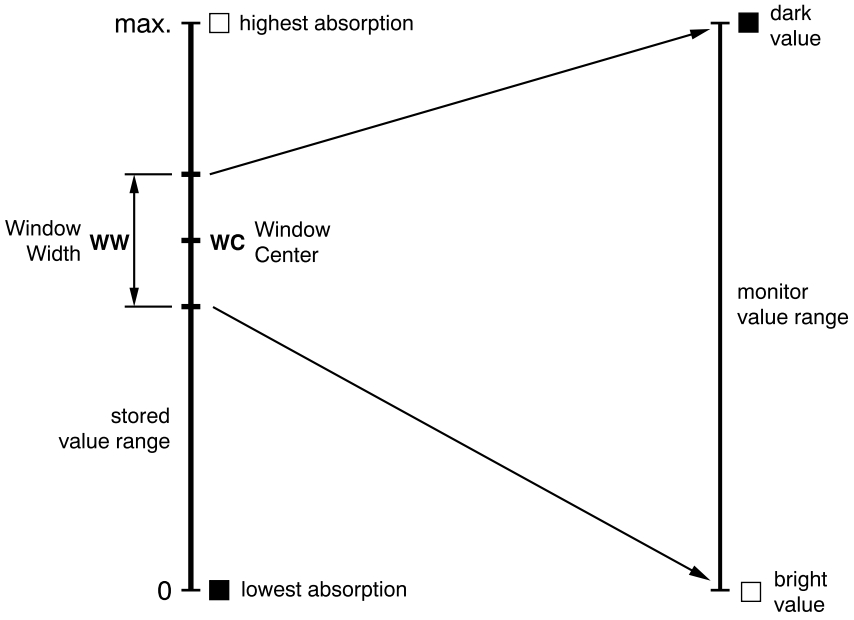
The individual pixels of an X-ray image are stored as integer values. These values represent a range of image brightness divided into increments much finer than the human eye can perceive. The monitor can display a specific (smaller) range of brightness values. The purpose of the windowing function is to define the range to be displayed and the way it should be displayed.

DR images The displayed window area is defined by a pair of numbers.

The values used for non-subtracted images are the *window center = WC* and the *window width = WW*.

DSA images DSA images displayed after subtraction (difference between fill and mask) can be windowed in the same way as native images.

For subtracted images, the *window brightness = WB* and the *window contrast = WC* are used.



Principle of windowing (display contrast agent/bones black)

Windowing

You can enter these values directly or set them with the mouse.

⇨ "Setting window values manually" on page 44

Window center

❑ The "image brightness" is altered by moving the window center.

Window width

❑ The "image contrast" is altered with the window width.

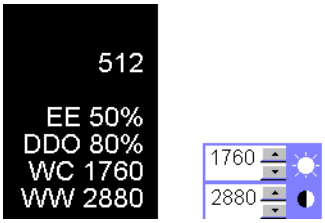
Value range

	Window center (native) Brightness (subtracted)	**WC** **WB**	WC WB	0 to 4095 for 12-bit images 0 to 1023 for 10-bit images 0 to 255 for 8-bit images
	Window width (native) Contrast (subtracted)	**WW** **WC**	**WW** WC	1 to 4095 for 12-bit images 1 to 1023 for 10-bit images 1 to 255 for 8-bit images

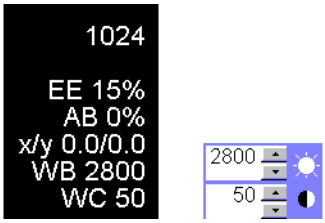
Display

The window values are displayed at the bottom right in the image (control room and exam room) and on the **Adjust** subtask card.

non-subtracted:



subtracted:



Auto Windowing

Depending on the examination performed, different window values (window center and window width) must be selected for an optimum display.

If you select **Auto Windowing**, window values based on an algorithm defined in the corresponding exam set and the existing exposure conditions are used. The computer optimizes window values on the basis of the gray scale statistics in the image and uses these values.

⇨ "Assigning automatic window values" on page 47.

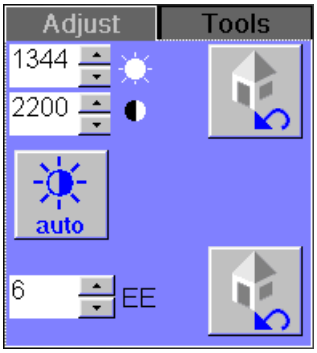
Setting window values

Extreme window values can change image display in such a way that a diagnosis is no longer possible.

- Check the image impression after windowing.

For biplane scenes, this function is performed only in the active plane.

At the system console



The current values are displayed on the **Adjust** subtask card. On this subtask card you can set the window values and activate edge enhancement filters.

Setting window values manually

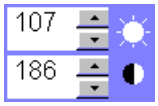
After acquisition, the image is displayed in accordance with the window values defined in the exam set.

All changes are stored automatically with the scene / with the image.

At the system console

Numerically

To use specific window values:



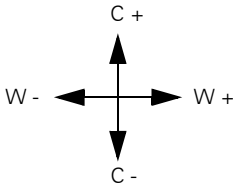
◆ Enter the values for window center/brightness and window width/contrast .

Or

◆ Click on the arrows.
– Windowing is performed simultaneously.

With the mouse

◆ Click into the image with the *middle* mouse button and move the mouse with the button pressed.
– The mouse pointer changes its shape (**WL**).



❏ upward:
– to increase window center/brightness values.

❏ downward:
– to decrease window center/brightness values.

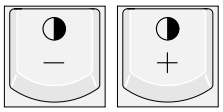
❏ to the right:
– to increase window width/contrast .

❏ to the left:
– to reduce window width/contrast .

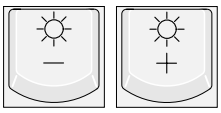
The image is displayed immediately with the changed window values.

With the keyboard

For fine adjustment of the window values, you can also use the keys on the symbol keypad of the keyboard:



- Press these keys to increase or reduce the window width/contrast *step by step*.

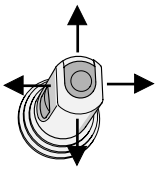


- Press these keys to increase/decrease the window center/brightness values *step by step* .

With the IS joystick

At the touchscreen control

- Activate **Window** (on the **PostProc** task card if the **Cardiac** profile is selected, to the left of the card stack if a different profile is selected).



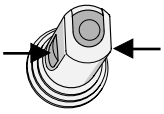
- Tilt the IS joystick.
  – The window values are altered accordingly (see above).

Undoing

At the system console

- Click on this icon.

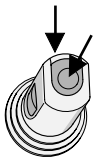
At the touchscreen control



- Press one or both of the **function buttons** on the side.
  – All changes since the last save operation are undone.

Closing

At the touchscreen control



- Press a **selection button** ("fire button") on the top or rear of the joystick.
  – The current values are accepted.
  – The function is deselected.

Or

- Deactivate **Window**.

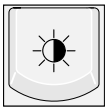
Assigning automatic window values

At the system console

With the mouse

◆ Click on this icon.

With the keyboard



◆ Press this key.

At the touchscreen control

◆ Activate **Auto Window** on the **PostProc** task card.

Now the images will be displayed with optimized window values typical for the examination in question.

Applying a filter

Edge enhancement filter

Depending on the examination (organ to be examined, dose, ...), it might be necessary to improve the display of edges or to improve the noise suppression. This is defined in the exam sets on the acquisition system but can be changed later.

Value range

Edge enhancement **EE**	0 to 100%

❏ Edge enhancement greater: sharper edges, more noise

❏ Edge enhancement less: softer edges, less noise

Extreme edge enhancement values can change image display in such a way that a diagnosis is no longer possible. Artifacts may appear.

◆ Check the image impression after filtering.

For biplane scenes, this function is performed only in the active plane.

Setting

At the system console

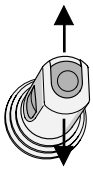
◆ Enter a percentage.

Or

◆ Use the arrows.
– The edge enhancement is performed simultaneously.

At the touchscreen control

◆ Activate **Edge Enhance**.



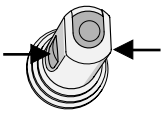
◆ Tilt the IS joystick.
– *Up*: *more* edge enhancement
– *Down*: *less* edge enhancement

Undoing changes

At the system console

◆ Click on this icon.

At the touchscreen control



◆ Press one or both of the **function buttons** on the side.

All changes since the last save operation are undone.

Closing

At the system console

If the **Adjust** subtask card is in the foreground, you can always perform filtering.

At the touchscreen control

◆ Press a **selection button** ("fire button") on the top or rear of the joystick.
– The current values are accepted.
– The function is deselected.

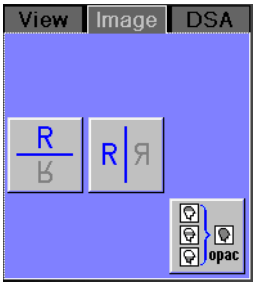
Or

◆ Deactivate **Edge Enhance.** .

Changing the image display

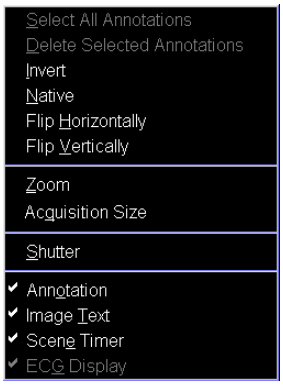
You will find further tools for changing the image display on the **Image** subtask card, in the **Image** menu, and in the popup menu (right mouse button).

Subtask card



Main menu

Popup menu



◆ Click the **Image** subtask card into the foreground.

⇨ Chapter **DSA Postprocessing**, "Generating the image with maximum contrast medium filling"

Invert ⇨ Chapter **Managing and Viewing Scenes/Images**, "Inverting grayscale values"

Max Fill Override ⇨ Chapter **Managing and Viewing Scenes/Images**, "Replacing the maximum fill image"

Flipping an image

You can flip images of a scene horizontally and/or vertically.

When you flip images, the orientation labels are adjusted accordingly.

⇨ "Orientation labels" on page 56

Warning

Image flipped

Confusion between up/down/left/right can cause incorrect diagnosis!

The examiner is responsible for using the functions and interpreting the images correctly and the consequences resulting from it.

- Check patient position data in the current image to exclude any errors.

For biplane scenes, only one plane is flipped because, depending on the projection, flipping in one plane might not automatically correspond to flipping in the other plane.

At the system console

- Click on the icon for the required function.

Or

- Select **Image > Flip Horizontally** / **Flip Vertically** from the main menu or **Flip Horizontally** / **Flip Vertically** from the popup menu.
  – The next time you select the menu, this item will be marked with a checkmark.

The image is flipped (top and bottom or left and right are swapped round).

To achieve rotation through 180°, perform both functions one after the other.

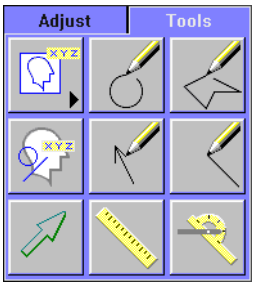
At the touchscreen control

⇨ Part **Examination**, Chapter **Preparing the Examination - Fluoroscopy - Acquisition**, "Flipping an image"

Adding text and graphics to images

At the system console

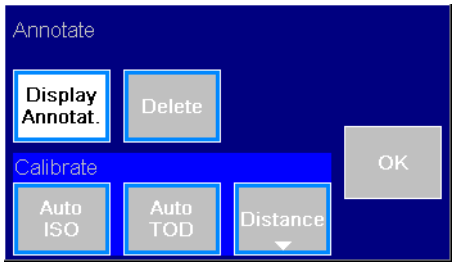
The tools for annotating images with text and graphics can be found on the **Tools** subtask card.

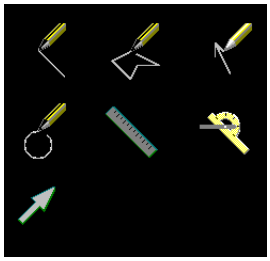


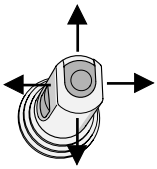
◆ If necessary, click the **Tools** subtask card into the foreground.

At the touchscreen control

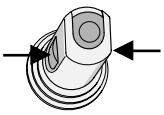
◆ Activate **Annotate** on the **PostProc** task card.
– The **Annotate** dialog box is displayed on the touchscreen.
– The graphic tools appear on the monitor in the examination room.







◆ Move the mouse pointer over the appropiate icon.



◆ Select it by pressing the **function button**.

General information about text and graphics

It is possible to create up to 75 graphic objects in each image.

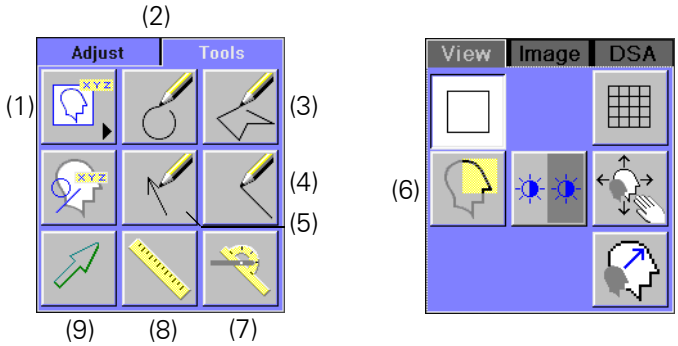
Image structure

According to the DICOM standard, a medical image consists of two "planes":

- ❏ a pixel image (in which graphics may also be "burnt")
- ❏ superimposed graphic elements (vector graphics)

Graphic elements

The user can draw graphic elements into images. Graphic elements include:



(1) Annotations

(2) Circles

(3) Polygons

(4) Lines

(5) Arrows

(6) Electronic shutter

Measurements

Graphics are also added with measurements, e.g. with

(7) Angles

(8) Distances

Pointer

(9) A pointer is available for temporary marking of image details.

⇨ Chapter **Managing and Viewing Scenes/Images**, "Using the pointer" on page 37

Operation

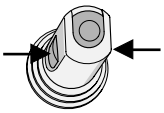
You can operate the graphic tools as follows:

At the system console

- Click and drag an object using the *left mouse button* of the *mouse*.
- Perform a *double click* when you want to finish an operation.

At the touchscreen control

You can perform the same functions, such as dragging and dropping graphic elements, using the **IS joystick**:



- Press one or both **function buttons** on its side and tilt the joystick.

- Press a **selection button** ("fire button") on the top or rear of the joystick when you want to finish an operation.

Switching on a graphic tool

You can use the tool until you switch it off again. For instance, you can draw several distances in an image one after the other.

inactive

active

- To switch on a graphic tool, select it from the menu or click on the relevant button.

– The mouse pointer becomes a graphic pointer.

Positioning a graphic element

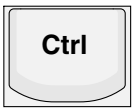
As soon as you have created a graphic element, you can move it to any place in the image:

- Move the mouse pointer onto the graphic element.
  – The mouse pointer changes shape.
- Click and drag the graphic element to the required position.

Selecting several graphic elements

If several graphic elements are drawn in an image, you can select them simultaneously to - for instance - delete or move them at the same time. Proceed as follows:

- Click on the first graphic element.
  – It is selected.



- Press the **Ctrl** key and keep it pressed.
- Click on the other graphic elements one after the other.
  – They too are selected.

Selecting all graphic elements

You can also select all graphic elements on the image at once.

- Select **Select All Annotations** from the popup menu.
  – The graphic elements are selected.

Deleting graphic element(s)

You can delete graphic elements at any time if you no longer require them:

- Click on the graphic element in question.
  – It is marked with a border.
- Press the **Del** key on the keyboard.

Or

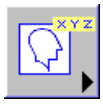
- Select **Delete Selected Annotations** from the popup menu.

The selected graphic elements are deleted.

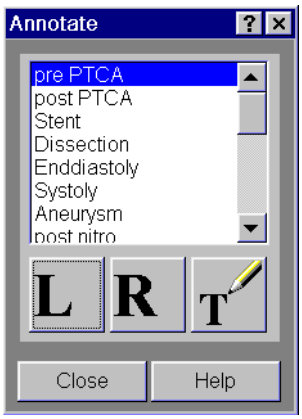
Annotating images (annotations)

At the system console

With the **Annotate** window you can set **R/L** labels, use predefined texts or enter free texts.



◆ Click on this icon.
– The **Annotate** dialog box is displayed.



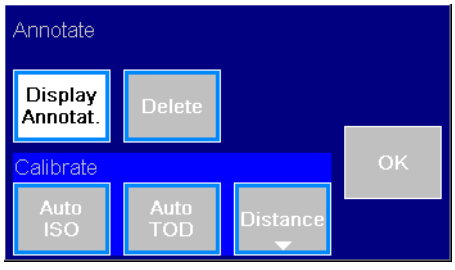
⇨ "Entering the laterality" on page 57

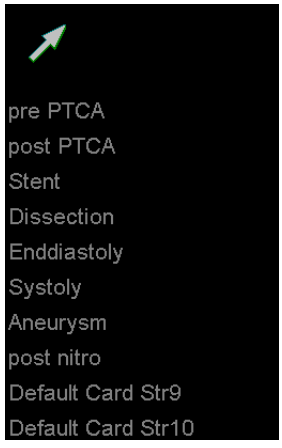
⇨ "Using predefined texts" on page 59

⇨ "Entering free texts" on page 59

At the touchscreen control

◆ Activate **Annotate** on the **PostProc** task card.
– The **Annotate** dialog box is displayed on the touchscreen.
– The graphic tools with predefined texts appear on the monitor in the examination room.





Orientation labels

Example

(1) Orientation labels[1]
- **H** = Head
- **F** = Feet
- **R** = Right
- **L** = Left
- **A** = Anterior[2]
- **P** = Posterior[2]

(2) Laterality of the organ displayed in the image
- **R** = Right
- **L** = Left

Patient orientation

Standard orientation labels (left center and top center in the image) are set automatically when the patient position is entered.[1]

[1] The orientation labels can be permanently hidden by Siemens Service.
[2] in the lateral position or angle >45° LAO/RAO

Laterality (right/left assignment)

You can also use **R** or **L** to label paired organs (e.g. kidneys).

Laterality (right/left assignment) applies to the *image content* (right/left organ) and *not* to the right/left side of the patient.

When transferring scenes/images, make sure that the recipient system can display the DICOM "Laterality" attribute.

Warning

Incorrect right/left labeling

Risk of incorrect diagnosis, e.g. surgical intervention on the wrong side

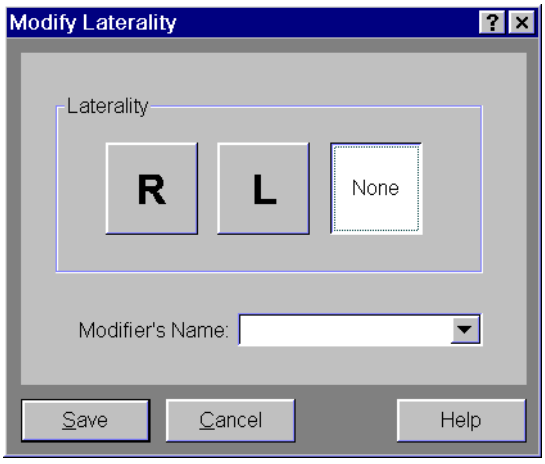
The examiner is responsible for correct right/left labeling.

- Make sure that the **R**/**L** labels have been placed correctly.
- If necessary, use lead letters or similar devices during fluoroscopy/acquisition.

Entering the laterality

At the system console (only)

- Click **R** or **L** in the **Annotate** window.
  – The **Modify Laterality** window opens.



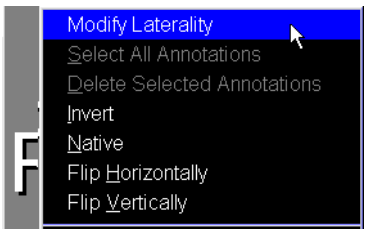
- Enter your name in the field.
- If the patient position is correct, confirm with **Save**.
  – The **R** or **L** label is displayed on the *left* in the lower part of the image.

Changing the laterality

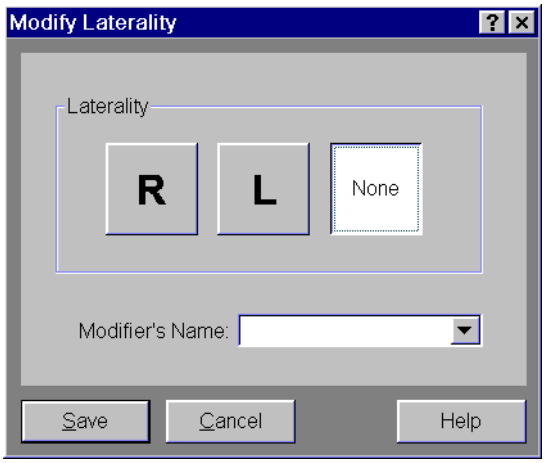
At the system console (only)

If an **R**/**L** label has been accidentally set incorrectly, you can change it or remove it.

- Move the mouse pointer onto the **R** or **L** label and press the right mouse button.



- Select **Modify Laterality** from the popup menu.

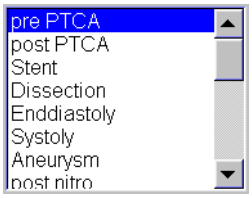


- Choose the correct laterality (**R**/**L** label) or **None**.
- Enter your name in the field.
- Confirm with **Save**.
  – The change is made immediately.

Using predefined texts

Setting texts

At the system console or at the touchscreen control

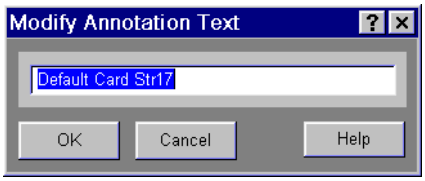


- Select an entry from the list with a single click; use the scroll bars to display further texts.
- Click on the required position in the image.
  – The text appears immediately.

Defining a text

Up to 20 predefined texts are possible. On installation the predefined texts have the default value "Default ... Str.##". You can change the texts at any time.

- Double-click on the required entry in the **Annotate** window.
  – The **Modify Annotation Text** window appears.



- Overwrite the text as required.
- Click on **OK**.

Entering free texts

Entering texts

At the system console (only)

- Click on this icon.
- Click on the required position in the image.
  – A text field appears.
- Enter the text via the keyboard.

- Complete the entry with the Enter key.

To modify a text, delete it by pressing the **Del** *key, and enter the text again.*

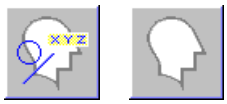
Canceling the entry

◆ Press the **Esc** key on the keyboard.
– The previously entered text is deleted.

Switching text/graphics display off/on

If you want to view the image without texts and graphic elements, you can switch the display on and off.

At the system console



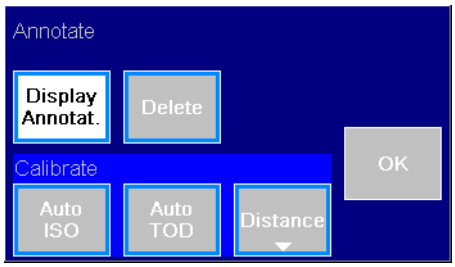
◆ Click on this icon.
– The symbol changes.

Or

◆ Select **View > Annotation** from the main menu or **Annotation** from the pop-up menu.
– The next time you select the menu, this item will be marked with a check-mark.

At the touchscreen control

◆ Activate **Annotate** on the **PostProc** task card.



◆ (De)Activate **Display Annotat.**

The texts and graphics are hidden or shown in the image.

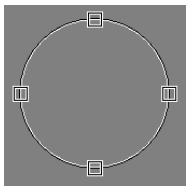
Drawing circles

If you want to emphasize image details, you can draw circles. You can also change their size.

Drawing in the circle **At the system console or at the touchscreen control**

- Click on this icon.
- Move the mouse pointer into the image.
  – The mouse pointer changes shape.
- Click on the detail of interest in the image and drag the mouse pointer.
  – A circle appears around this point.

Changing the size

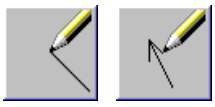


- Click on one of the four boxes on the circle border, keep the mouse button pressed, and drag the circle to make it larger or smaller.
  – The size of the circle changes, while the center remains fixed.
- Release the mouse button.

Drawing lines or arrows

You can emphasize image details with lines or arrows:

Drawing **At the system console or at the touchscreen control**



- Click on the required icon.
- Move the mouse pointer into the image.
  – The mouse pointer changes shape.
- Click on the image to fix the starting point (= arrow head), and drag a line to the end point with the mouse.
- Release the mouse button to end the line.
  – The line or arrow is drawn.

Changing

- Click on one of the two end points of the line/arrow, hold the mouse button pressed, and change the line/arrow as required.
- Release the mouse button.

Drawing polygons

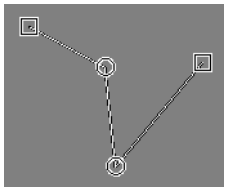
Drawing **At the system console or at the touchscreen control**

- Click on this icon.
- Move the mouse pointer into the image.
  – The mouse pointer changes shape.

(Open) polygon

- Click in the image to set the starting point, hold down the left mouse button and draw a line to the *first* corner point with the mouse.
- Draw the polygon point by point by clicking the mouse button once at each change of direction.
- Double-click on the *last* corner point.
  – The polygon is drawn.

Changing



- Click on the polygon line.
  – The end points and corner points are marked.
- Click on one of the end points or corner points, hold the mouse button pressed, and change the polygon as required.
- Release the mouse button.

Calibration

To perform a measurement (e.g. distance), the image must be calibrated.

If a calibration is stored with the image, this calibration can be used. If an image is not calibrated or if you want to improve the calibration, you can perform manual calibration based on known dimensions of an object in the image.

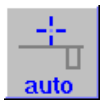
Calibration methods

Depending on the examination, you can use different calibration methods:

automatic

- **Auto ISO**
  Calibration is performed fully automatically for an organ positioned in the isocenter (= rotation center) on the basis of the known exposure geometry. Siemens Service performs an exact calibration for this exposure geometry during installation of the system.
  – Advantage: You can work quickly.
  – Disadvantage: This calibration method should be used only if the organ to be examined was in the isocenter during the acquisition. Otherwise there can be significant measuring uncertainties.

semi-automatic



- **TOD** (table-object distance)
  The calibration is automatically computed based on the known exposure geometry. You only need to enter the TOD.
  Siemens Service performs a precise calibration when the system is installed.
  – Advantages: The TOD is same in the supine position for most patients. You can work quickly.
  – Disadvantage: The error in the TOD value limits the measurement accuracy.

manual

❑ **Distance** (**Manual Calibration**)
Calibration is based on the known distance between two points of an object of known dimensions in the image.
– Advantage: The distance can be measured accurately.
– Disadvantage: Measuring errors can occur due to projectional geometrical distortion.

Which calibration method for which angulation angle?

0° ... 15° For angulations 0° ... 15°, the system performs an automatic calibration because minor distortions occur in this angulation range.

You can start immediately with measurement.

15° ... 50° For angulations 15° ... 50°, if the object was at a defined distance from the table-top, you can use automatic TOD calibration. If that was not the case, we recommend to use manual calibration.

For TOD calibration, you must mark a point of interest and confirm or enter the Table-Object Distance (TOD).

For manual calibration, you must draw a distance line and enter its length.

>50° For angulations >50°, if the object of interest was positioned in the isocenter, we recommend to use automatic isocenter calibration. If that was not the case, we recommend to use manual calibration.

Starting calibration

At the system console

Warning

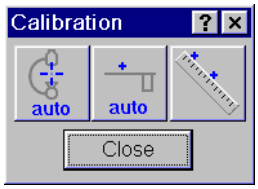
Incorrect calibration

Inaccurate results possible

The examiner is responsible for applying the correct calibration method.

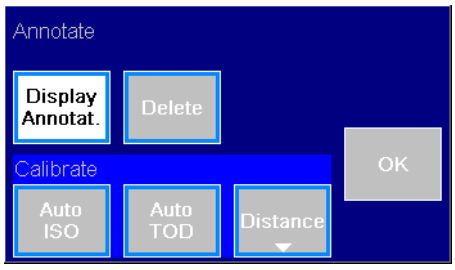
- Perform calibration carefully.

- Select **Options > Calibration** from the main menu.
  – The **Calibration** dialog box opens.



At the touchscreen control

- Activate **Annotate** on the **PostProc** task card.



Auto ISO ⇨ Part **Quantification**, Chapter **Calibration**, "Automatic isocenter calibration"

Auto TOD ⇨ Part **Quantification**, Chapter **Calibration**, "Calibration using the table-object distance (TOD)"

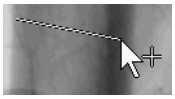
Performing manual calibration

The calibration object should be larger than the object to be measured.
The calibration object must also be located in the same plane as the object to be measured!

◆ Click on this icon.

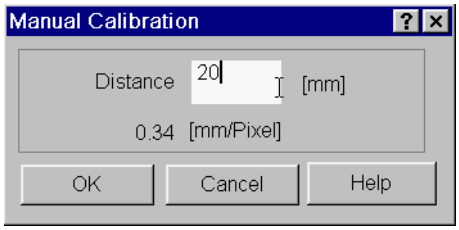
Drawing the distance line

◆ Move the mouse pointer into the image.
– The mouse pointer changes shape.



◆ Click on the image to mark the starting point and drag the mouse to the end point.
– As soon as you move the mouse, a line is displayed.

◆ Release the mouse button to end the line.
– The **Manual calibration** dialog box opens.



Entering a distance

Finally, enter the actual length of the distance used for calibration:

◆ Enter the length of the distance line (in mm).

◆ Confirm by clicking **OK** or pressing the Enter key.
– The calibration is applied.

Drawing and measuring distances

You can measure the distance between two points in an image with the help of a distance line.

Note that distance measurements on the **PostProc** task card are only valid for calibrated images.
Images are normally calibrated automatically.
However, you can calibrate images manually.

⇨ "Calibration" on page 63

Make sure that the calibration object and the object to be measured have the same geometric and acquisition parameters, that is,

- ❏ the same focus-to-object and object-to-I.I./FD distances
- ❏ the same I.I./FD size
- ❏ the same image matrix

Otherwise the absolute distances will not be reliable.

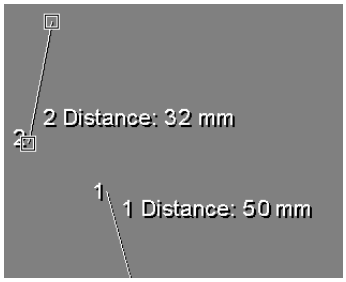
To calibrate the image, use objects whose size matches that of the object to be measured.

For distance measurements, it is advisable to calibrate over a distance of at least 3 cm.

Drawing a distance

At the system console

- ◆ Click on this icon.
- ◆ Click on the image to mark the first point and drag the mouse to the second point.
  – As soon as you move the mouse, the length of the line drawn up to this point is displayed.
- ◆ Release the mouse button to end the line.
  – The distance line is drawn showing the a number and the distance.

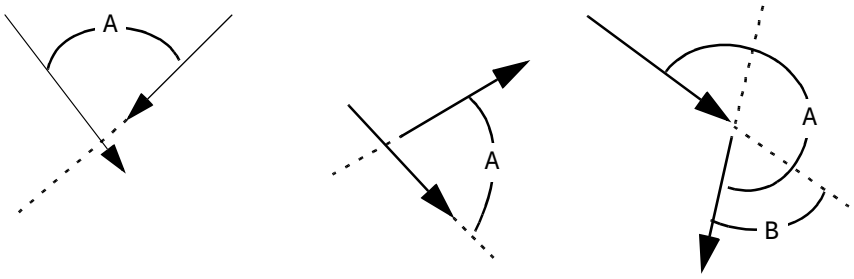


Changing the distance line

- Click on one of the two end points of the distance line, keep the mouse button pressed, and drag the line to enlarge or decrease it.
  – The distance is updated as soon as you move the mouse pointer.
- Release the mouse button.

Drawing and measuring angles

You can define an angle by drawing two lines - the sides of the angle - in the image. The system determines the angle between the two drawn lines *clockwise*. If the angle is larger than 180°, the program subtracts 180° from the angle.



(1) (2) (3)

The arrow direction shows the direction in which you have drawn the sides of the angle.

(1) Both sides have been drawn in the direction of the point of intersection. Angle A between the sides is displayed.

(2) Both sides have been drawn away from the point of intersection. Angle A between the sides is displayed.

(3) Otherwise angle B (A - 180°) is displayed.

An angle can only be measured correctly if the angle plane is parallel to the acquisition plane.

If the angle approximates to 90°, 180°, 270°, it is not clear whether the angle between the legs or the supplementary angle has been entered.

- Label the angle with an annotation when you display the supplementary angle.

Drawing an angle

At the system console or at the touchscreen control

Tip: Draw the lines in the image from outside to inside.

- Click on this icon.
- Move the mouse pointer into the image.
- Set the mouse pointer on a starting point for the first side.
- With the left mouse button pressed, draw a line to the end point of the first side.
- Release the mouse button there and press it again.
- Draw the second side in the same way.
  – The measured angle is displayed while you are drawing it.
- Release the mouse button at the end point of the second side.
  – The angle is drawn.

The two sides of an angle are provided with the same number, so that you can clearly distinguish between several angles.

Changing the angle

You can change the sides of an angle independently of one another.

- Move the mouse pointer into the image.
  – The mouse pointer changes its shape at positions where you can change a side of the angle.
- Move the entire line or drag an end point to a new position.
  – The angle is continuously updated.

DSA Postprocessing

Introduction

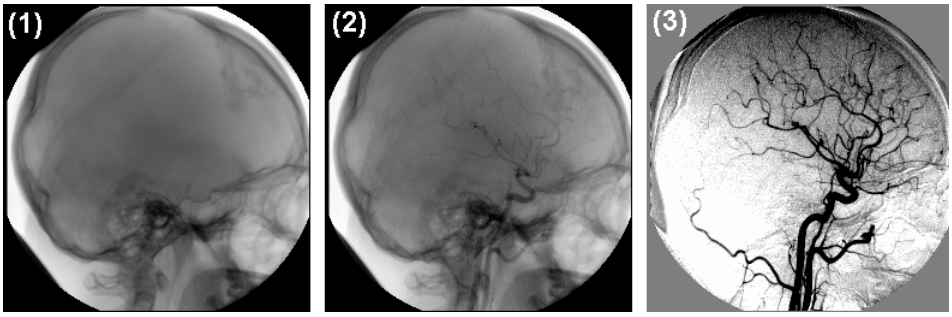
Unlike bones, vessels do not exhibit a significantly greater absorption of X-rays than the surrounding tissue. As a result, vessels are not particularly emphasized in X-ray images if you do not take further measures to ensure this.

In *digital subtraction angiography (DSA),* X-rays of the region to be examined are taken:

- ❏ *without* contrast medium (CM): *mask images*
- ❏ *with* contrast medium (CM): *fill images*

Then a *subtraction* is performed between fill and mask images.

The regions with the same attenuation cancel one another out in the subtraction image and the regions with (slightly) different attenuation, such as vessels containing contrast medium when acquired, are clearly emphasized.



(1) Mask image (without CM)

(2) Fill image (with CM)

(3) Subtracted image

DSA postprocessing functions

The following postprocessing functions can be used to optimally display subtracted images:

- ❏ Setting the mask
  Selecting an image without contrast medium which is subtracted from all images of a scene containing contrast medium.
- ❏ Native/subtracted
  Switching over between unsubtracted/subtracted display

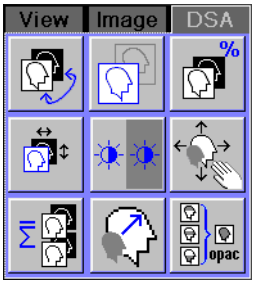
- ❏ Anatomical background
  The mask is faded into the subtracted image in order to show the surrounding tissue in addition to the vessels (e.g. bones).
- ❏ Pixelshift
  Method for making images and the mask coincide exactly.
- ❏ Max Opac (Min Opac in CO_2 DSA)
  An image in which the vessels are almost completely filled with contrast medium is generated.
- ❏ Image and mask averaging
  Several images are averaged for the mask and fill run.
  This reduces noise interference, especially if the dose is low.
- ❏ Invert
  Inverting grayscale values
- ❏ Zoom/pan
  Magnifying the image and shifting the image detail

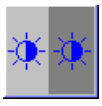
DSA tools

At the system console

On the **DSA** subtask card you will find the tools with which you can optimally display a scene after subtraction.

◆ Click the **DSA** subtask card into the foreground.



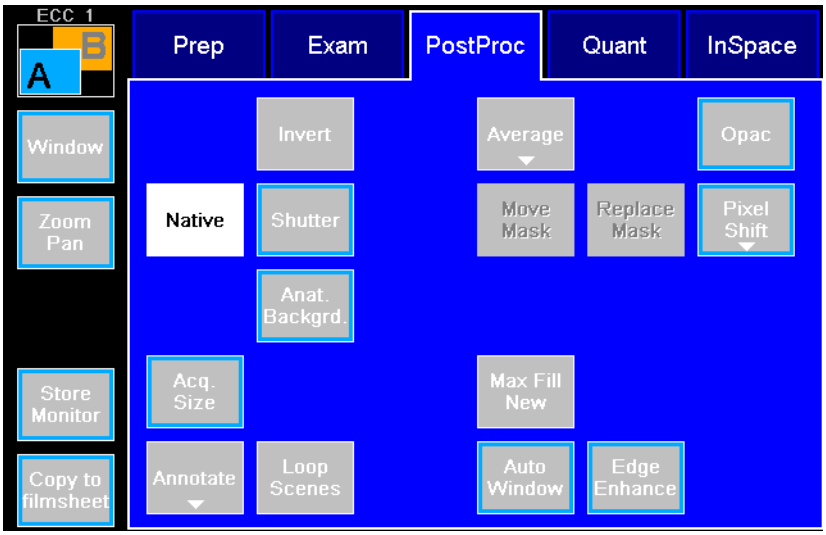


⇨ Chapter **Managing and Viewing Scenes/Images**, "Inverting grayscale values"

⇨ Chapter **Managing and Viewing Scenes/Images**, "Magnifying the scene/image, zooming/panning"

At the touchscreen control

- Activate the **PostProc** task card.



Example (depends on system and configuration)

Setting a new mask

During a DSA exposure, the mask (= image without contrast medium) is set automatically. This normally occurs after the second frame, but no later than after two seconds.

You can change the automatically set mask image.

All pixelshift values are reset when you set a new mask.

For biplane scenes, this function is performed only in the active plane.

In the case of DYNAVISION scenes, only one mask image is usually available per acquisition position (exception: washout scene).

The mask can therefore not be redefined for DYNAVISION scenes.

Default setting "Move Mask" or "Replace Mask"

Setting a new mask can be done via "Move Mask" or "Replace Mask".

Setting "Move mask"

- Select **Options > Set Move Mask** from the main menu.
  – "Move Mask" is active.
  – The next time you select the menu, the text of this item will be changed.

Setting "Replace Mask"

- Select **Options > Set Replace Mask** from the main menu.
  – "Replace Mask" is active.
  – The next time you select the menu, the text of this item will be changed.

Moving the mask

Prerequisite: "Move Mask" is configured.

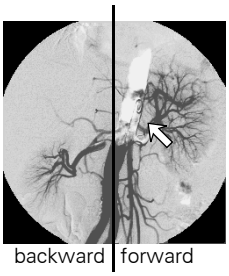
At the system console

- Click on this icon.

Now you can scroll through the *masks one by one* as in the case of normal scene review:

◆ Click on a single step button.
– The *mask* is scrolled forward or backward by one frame.

Or



◆ Click into the image area (with the left mouse button).
– If you click into the *left* part of the image, the *mask* is scrolled *backward* by one frame (toward the beginning of the scene).
– If you click into the *right* part of the image, the *mask* is scrolled *forward* by one frame (toward the end of the scene).

When you reach the frame you want to select as the mask:

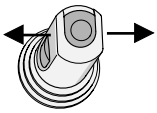
◆ Click on this icon.

The frame whose number is displayed on the left edge of the monitor next to **M** is set as the mask for the scene.

At the touchscreen control

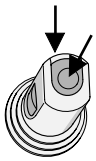
◆ Activate **Move Mask** on the **PostProc** task card.

Now you can scroll through the *masks one by one* as in the case of normal scene review:



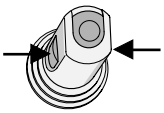
◆ Tilt the IS joystick.
– The *mask* is scrolled forward or backward by one frame (both planes for biplane scenes).

When you reach the frame you want to select as the mask:



◆ Press a **selection button** ("fire button") on the top or rear of the joystick.
– The current frame is stored as the mask (both planes for biplane scenes).
– The function is deselected.

Or



◆ Press one or both of the **function buttons** on the side.
– The current frame is stored as the mask.
– In biplane scenes, the plane is switched over.

◆ Move the mask in the other plane.

Replacing the mask

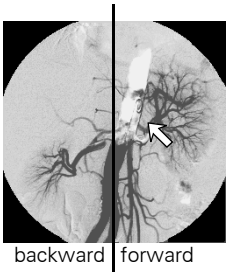
Prerequisite: "Replace Mask" is configured.

Scroll through the *scene image by image* in the same way as during normal scene review:

At the system console

- Click on a single step button.
  – The *scene* is scrolled forward or backward by one image.

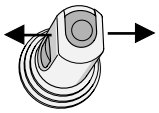
Or[1]



- Click into the image area (with the left mouse button).
  – If you click into the *left* part of the image, the *scene* is scrolled *backward* by one image.
  – If you click into the *right* part of the image, the *scene* is scrolled *forward* by one image.

- Click on this icon.
  – The current image is set as the mask for this scene.

At the touchscreen control



- Tilt the IS joystick.
  – The previous/next image is displayed.

- Activate **Replace Mask** on the **PostProc** task card.
  – The current image is set as the mask for this scene.

[1] not for a zoomed image or after clicking on a graphic object

Switching over between subtracted and unsubtracted display

A DSA or PERIVISION acquisition scene is generally displayed subtracted. However, each subtracted scene can also be displayed unsubtracted, that is, native.

In biplane scenes, the scenes of both acquisition planes are displayed unsubtracted if you select **Native**.

Native **At the system console**

- Click on this icon.
  – The scene is displayed native (unsubtracted).

Subtracted **At the system console**

- Click on this icon again.
  – The scene is displayed subtracted.

Native **At the touchscreen control**

- Activate **Native** on the **PostProc** task card.
  – The scene is displayed native (unsubtracted).

Subtracted **At the touchscreen control**

- Deactivate **Native**.
  – The scene is displayed subtracted.

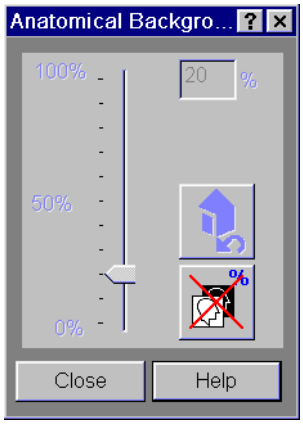
Fading in anatomical background

The anatomical surroundings of the vessels of interest are normally not visible in a subtracted scene. The surrounding tissue can be emphasized more or less by fading in the native image. The initial degree of fading-in is defined in the exam set. You can alter this fade-in setting.

For biplane scenes, this function is always performed in one plane only.

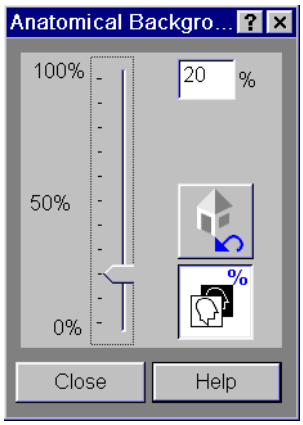
Starting **At the system console**

◆ Click on this icon.



Switching anatomical background on

◆ Click on this icon.
– The image is displayed *with* anatomical background.



Changing anatomical background

You can set the anatomical background between 0% and 100%.

❏ 0% corresponds to subtracted display

❏ 100% correspond to unsubtracted display (native)

◆ Click and drag the slider.

Or

◆ Enter a percentage in the input field and confirm with the Enter key.
– The scene is replayed with anatomical background.
(The degree of fading-in is stored with the scene if necessary.)

Background off/on

◆ Click on this icon.
– The image is displayed subtracted *without* anatomical background.
(You can no longer set the anatomical background.)

◆ Click on this icon.
– The image is displayed *with* anatomical background again.

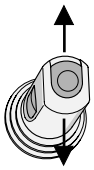
Undoing changes

◆ Click on this icon.
– All changes since the last save operation are undone.

Changing the background

At the touchscreen control

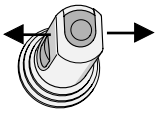
◆ Activate **Anat. Backgrd.** (on the **PostProc** task card or left of the card stack).



◆ Tilt the IS joystick.
– *Up*: *more* anatomical background
– *Down*: *less* anatomical background

Speed

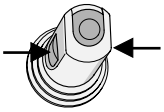
You can control the speed with which the scene is reviewed by tilting the IS joystick to the side:



◆ Tilt the IS joystick.
– The further left or right the joystick is tilted, the faster the scene will be played back.

Switching over

You can switch between 0% anatomical background and the initial value:

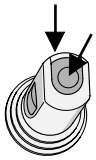


◆ Press one or both of the **function buttons** on the side.
– The scene is displayed with 0% anatomical background.

◆ Press one or both of the **function buttons** on the side again.
– The scene is displayed with the initial value.

etc.

Closing



◆ Press a **selection button** ("fire button") on the top or rear of the joystick.
– The current value is accepted.

Or

◆ Deactivate **Anat. Backgrd.** .

Making the image and mask coincide exactly (Pixelshift)

Using pixelshift, it is possible to adjust fill and mask images to coincide in subtracted scenes.

In the case of DYNAVISION scenes, only one fill image and one mask image is usually available per acquisition position.
Pixelshift may need to be carried out individually for each acquisition position.
Use automatic pixelshift to shift a range of mask and fill frames.

For biplane scenes, this function is performed only in the active plane.

Motion artifacts

The patient or the system could have moved slightly between exposures with and without contrast medium. As a result, the images used for subtraction might not coincide completely. If this happens, the anatomical background is not removed completely, especially in the region of image contrasts (motion artifacts).

Pixelshift

You can make the image and mask match exactly by shifting the mask by a few pixels or fractions of pixels.

ROI

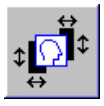
However, you may not be able to achieve good results for all regions of the image as different pixelshift amounts may be necessary in different regions of the image because of the image geometry and elasticity of the human body.

Variants

Pixelshift can be performed in the following ways:

❏ Manual pixelshift
You shift the mask manually to achieve the best subjective impression.

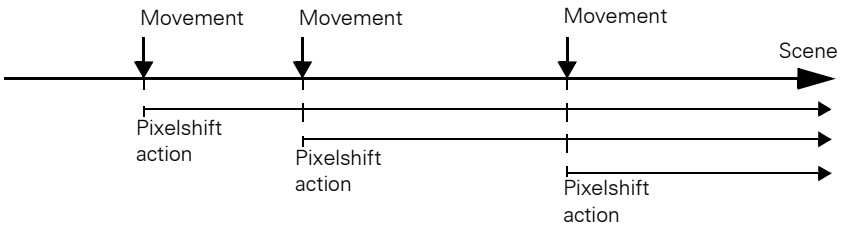
❏ Automatic pixelshift:
Enter the region of interest (ROI) in an image or for a number of images in a scene for which you want to optimize the pixel shift. The computer automatically calculates the best result for this region.



❏ Flexible pixelshift:
The image is divided into a "chessboard". The computer independently calculates the best pixelshift value for each square. Pixelshift is adapted "flexibly" to the image.

Scope of action

Each pixelshift action (automatic or manual) always applies to the current image and all images up to the end of the scene.

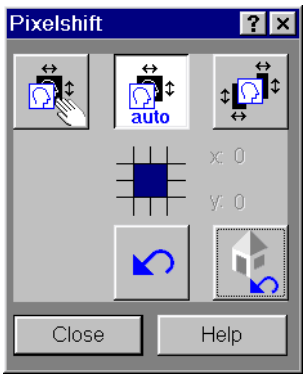


It is therefore advisable to start with pixelshift at the beginning of the scene. You can then scroll through the scene to the end. Each time motion artifacts appear (if the patient or unit has moved), you can make a further pixelshift correction.

Starting pixelshift

At the system console

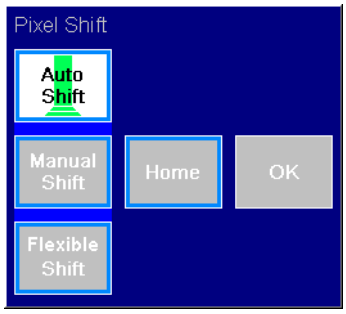
◆ Click on this icon.
– A window appears.



The pixelshift magnitudes in the horizontal (x) and vertical (y) direction are displayed in the **Pixelshift** *window.*

At the touchscreen control

◆ Activate **Pixel Shift** on the **PostProc** task card.
– A window appears.



The pixelshift magnitudes in the horizontal (x) and vertical (y) direction are displayed on the monitor.

Automatic pixelshift is active.

Automatic pixelshift

At the system console

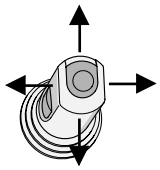
◆ Click this icon, if necessary.
– A square for the region of interest (ROI) is drawn in the middle of the image.

◆ Click and drag the square to the required position.
– The mask is shifted in such a way that subtraction is optimized for the marked region.

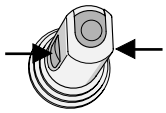
◆ Page on in the scene.

At the touchscreen control

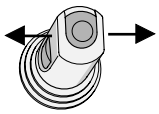
◆ Activate **Auto Shift**, if necessary.



◆ Tilt the IS joystick.
– The square is shifted accordingly.



◆ Confirm by pressing one or both **function buttons** on the side.



◆ Page on in the scene.

Further pixelshift corrections

If you scroll back and then perform pixelshift, the pixelshift values you set (further back in the scene) may be overwritten.
Therefore scroll forward only, if possible.

If motion artifacts occur again:

◆ Position the square at the correct position again.

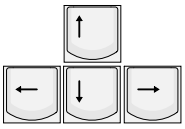
At the end of the scene, automatic pixelshift is automatically deselected.

Manual pixelshift

At the system console

- Click on this icon.
- Click and drag in the image area.

Or



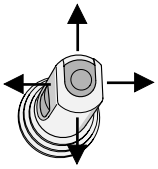
- Press an arrow key.

The mask is shifted simultaneously (by small amounts).

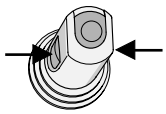
- Page on in the scene.

At the touchscreen control

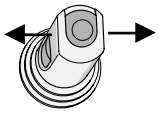
- Select **Manual Shift**.



- Tilt the IS joystick.
  – The mask is shifted simultaneously (by small amounts).



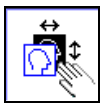
- Confirm by pressing one or both of the **function buttons** on the side.



- Page on in the scene.

Deselecting pixelshift

At the system console



- Click on this icon again.
  – The pixelshift values are accepted.

At the touchscreen control

- Press a **selection button** ("fire button") on the top or rear of the joystick.
  – The pixelshift values are accepted.
  – The function is deselected.

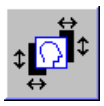
Or

- Deactivate **Manual Shift**.
  – The function is deselected.

At the end of the scene, manual pixelshift is automatically deselected.

Flexible pixelshift

At the system console



- Click on this icon.

At the touchscreen control

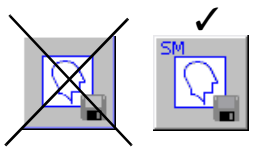
- Activate **Flex Shift**.

The mask is divided into squares like a chessboard. The optimum shift amount is determined and applied automatically to each square.

"Flex" is shown in the image.

Store Monitor

Saving changes



A "Flex" image can be stored using the **Store Monitor** function.

- Click on this icon.

You can also store the flexible pixelshifted image as a reference image or copy it to the filmsheet.

Undoing pixelshift

Undo

At the system console

◆ Click on this icon.

The last pixelshift action is undone.

Home

At the system console

◆ Click on this icon.

At the touchscreen control

◆ Activate **Home**.

All changes since the last save operation are undone.

Generating the image with maximum contrast medium filling

Usually the contrast medium does not fill the vessels uniformly after it is injected, but the contrast medium bolus "travels" through the vessels.

The opacity function (Max Opac or Min Opac in CO_2 DSA) is used to integrate the images of the fill phase (= phase in which contrast medium is in the vessels of interest). The pixels filled with contrast medium from different images are combined into one image. The entire path taken by the contrast medium is displayed in one image.

The opacity function cannot be applied to DYNAVISION scenes.

For biplane scenes, this function is always performed simultaneously in both planes.

Starting

◆ Scroll to the starting image.

At the system console

Bolus start

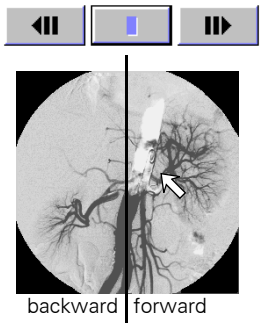
At the image in which the contrast agent bolus is visible *for the first time*:

◆ Click on this icon.
– From now on, the images are summated.

Scrolling

The scene can be scrolled forward or up to one image backward.

Scroll the scene *image by image*:



◆ Click on the single step button.

Or

◆ Click into the image area (with the left mouse button).
– With every step forward, a further image is added to the Opac image.
– The image with maximum contrast medium filling is calculated and displayed immediately.

Bolus end When the optimum contrast medium filling is displayed, you can save the image.

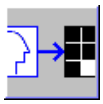
As Reference Image

◆ Click on this icon.

As Store Monitor

◆ Click on this icon.

To film sheet



◆ Click on this icon.

Opac end The function remains active as long you do not deselect it.

◆ Click on the Opac icon again.

The scene is displayed normally again.

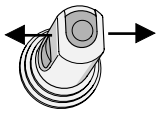
At the touchscreen control

Bolus start At the image in which the contrast agent bolus is visible *for the first time*:

◆ Activate **Opac** on the **PostProc** task card.

Scrolling The scene can be scrolled forward or up to one image backward.

Scroll the scene *image by image*:



◆ Tilt the IS joystick.
– With every step forward, a further image is added to the Opac image.
– The image with maximum contrast medium filling is calculated and displayed.

◆ Press a **selection button** ("fire button") on the top or rear of the joystick.
– The image is selected as the end image.
– The image with maximum contrast medium filling is calculated and displayed.

As Reference Image

- Press a **selection button** ("fire button") on the top or rear of the joystick.

Or

As Store Monitor

- Activate **Store Monitor** (to the left of the card stack).

Or

To film sheet

- Activate **Copy to filmsheet**.

Or

Deselecting

- Deactivate **Opac**.

The scene is displayed normally again.

Improving the noise suppression of a scene (averaging)

Particularly if a small dose is used, we recommend using the average of several images instead of an individual image as the mask because averaging reduces noise.

Averaging can be performed with mask images and/or fill images. Averaging mask images is particularly useful if you want to reduce noise in DSA scenes. Fill images, however, should be averaged only if you want to display non-pulsating vessels as otherwise vessel edges will be blurred.

Mask averaging is not possible for unsubtracted scenes.

The higher the number of images used for averaging, the better the noise suppression.

We recommend averaging both mask images and fill images for DSA scenes.

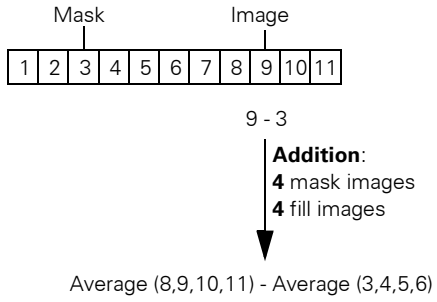
Averaging cannot be used for DYNAVISION scenes.

For biplane scenes, this function is always performed simultaneously in both planes.

Rules Averaging is performed according to the following rules:

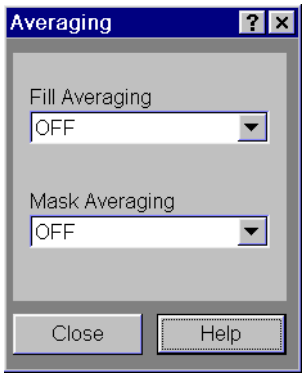
- ❏ For mask images, addition is carried out in the "forward" direction, i.e. the selected mask image and the subsequent mask images are added.
- ❏ For fill images, addition is carried out "in both directions", i.e. the fill image(s) before and after the selected fill image is/are added.
- ❏ In Loop the scene is limited to images for which addition can be carried out correctly. In other words, no image is used twice for the calculation.
- ❏ The summed mask image is subtracted from the summed fill image.

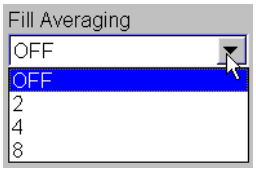
Example:



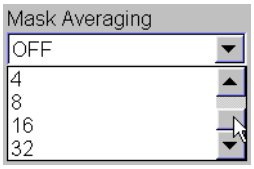
At the system console

- ◆ Click on this icon.





◆ Select the number of fill images to be used for averaging.

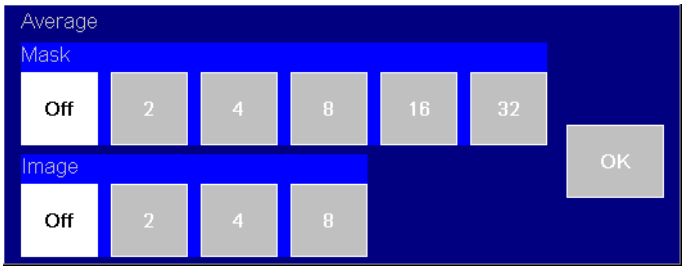


◆ Select the number of mask images to be used for averaging.

The calculation is carried out immediately and applied to the scene.

At the touchscreen control

◆ Activate **Average** in the **PostProc** task card.
– The available values are displayed.



◆ Select the new number of mask images and fill images to be averaged under **Mask** and **Image** respectively.

◆ Confirm with **OK**.

The calculation is carried out immediately and applied to the scene.

Undoing averaging

◆ Select mask average **Off**.
– The scene is displayed with unaveraged mask again.

Displaying the Exam Protocol

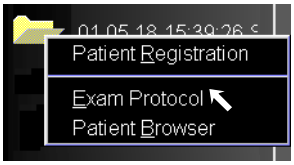
All parameters of an examination related to fluoroscopy and acquisition are recorded automatically in the **Exam Protocol** . You can also enter comments.

Calling up the Exam Protocol

At the system console only

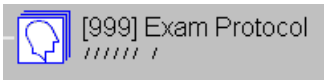
- Select the required patient.
- Select **Patient > Exam Protocol... from the main menu.** .

Or

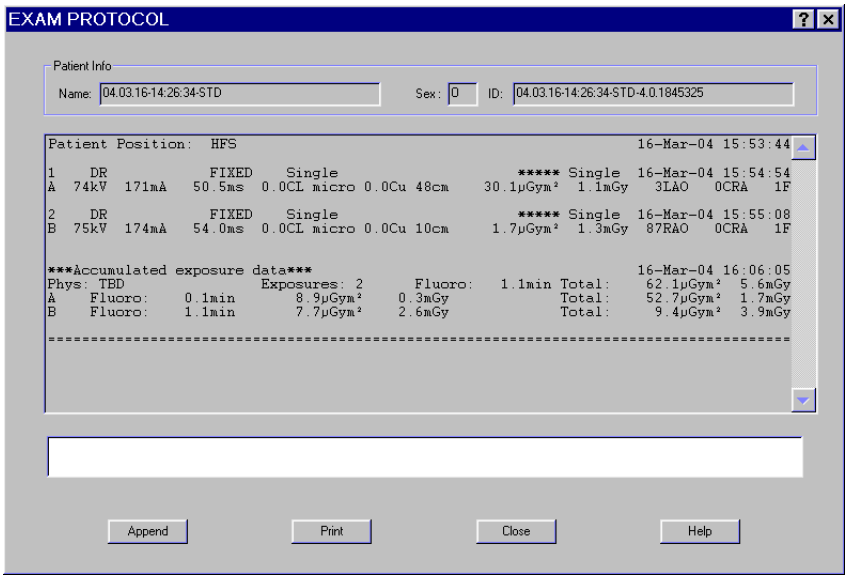


- Click on the folder icon with the right mouse button and from the popup menu, select **Exam Protocol...** .

Or



- Double-click on the **Exam Protocol** icon in the **Patient Browser**.


EXAM PROTOCOL
Patient Info
Name: 04.03.16-14:26:34-STD
Sex: 0
ID: 04.03.16-14:26:34-STD-4.0.1845325
Patient Position: HFS
16-Mar-04 15:53:44
1 DR FIXED Single ***** Single 16-Mar-04 15:54:54
A 74kV 171mA 50.5ms 0.0CL micro 0.0Cu 48cm 30.1µGym² 1.1mGy 3LAO 0CRA 1F
2 DR FIXED Single ***** Single 16-Mar-04 15:55:08
B 75kV 174mA 54.0ms 0.0CL micro 0.0Cu 10cm 1.7µGym² 1.3mGy 87RAO 0CRA 1F
Accumulated exposure data
16-Mar-04 16:06:05
Phys: TBD Exposures: 2 Fluoro: 1.1min Total: 62.1µGym² 5.6mGy
A Fluoro: 0.1min 8.9µGym² 0.3mGy Total: 52.7µGym² 1.7mGy
B Fluoro: 1.1min 7.7µGym² 2.6mGy Total: 9.4µGym² 3.9mGy
Append
Print
Close
Help

Entries in the Exam Protocol

Window contents

Patient information is displayed in the upper part of the window.

"Events" are listed in the center part of the window. If there are more entries than can be displayed in the menu, you can use the scroll bar (on the right) to display the required section of the examination data.

Below that, an input field for your comments is available.

Please note that the (automatically generated) entries in the **Exam Protocol** are displayed always in English, whatever language for the user interface is configured.

Patient position

The **Exam Protocol** starts with the registration of the patient, i.e. the registration or change of the patient position.

Example: **Patient Position: HFS 16-Mar-04 15:53:44**

Abbreviation (always in English)	**Patient Position** (English term)
HFS	**Head First - Supine** (Head First - Supine)
HFP	**Head First - Prone** (Head First - Prone)
HFDL	**Head First - Left Lateral** (Head First - Left Lateral)
HFDR	**Head First - Right Lateral** (Head First - Right Lateral)
FFS	**Feet First - Supine** (Head First - Supine)
FFP	**Feet First - Prone** (Feet First - Prone)
FFDL	**Feet First - Left Lateral** (Feet First - Left Lateral)
FFDR	**Feet First - Right Lateral** (Feet First - Right Lateral)

Radiation events Every radiation event (fluoroscopy or acquisition) is recorded.

Please note that the values given in the examination protocol are nominal values i.e. the values are *not* measured values but target values.
The real values may differ!

Each event entry consists of two lines. The following parameters are listed:

Entry (from left to right)	**Example** (always in English)	**Explanation**
First line:		
Number	**1**	Number of radiation event / scene number
Acquisition mode	**DR**	DR (Digital Radiography)
	DSA	DSA (Digital Subtraction Angiography)
	CARD	CARD (Cardiography)
	DR_DYNA	DR-DYNAVISION
	DYNA	(DSA-)DYNAVISION
	DR_STEP	PERISTEPPING
	PERI	PERIVISION
	DR_SCAN	DR-Scanning
Acquisition position	**(1)**	Number of acquisition position (only with PERISTEPPING/PERIVISION)
Frame rate control	**FIXED**	**Framerate Ctrl**: **Fixed** frame rate
	VARIABLE	**Framerate Ctrl**: **VFR Manual** or **VFR Time** (variable frame rate)
	PERIAUT	**Stepping Mode**: **Auto**
	PERIMAN	**Stepping Mode**: **Manual**
	DYNAAUT	**Dyna Control**: **Auto Inj.** (automatic injection)
	DYNAMAN	**Dyna Control**: **Manual Inj.** (manual injection)
	SCANSLOW	**Scan: Slow** (only on Artis dMP)
	SCANFAST	**Scan: Fast** (only on Artis dMP)
Acquisition program	*<any>*	Name of acquisition program
Scene length	**11s**	Length of scene
Frame rate	**2F/s**	Frame rate of scene in frames per second (starting frame rate)
	Single	Single image
Date and time	**16-Mar-04 15:54:54**	Date and time of radiation exposure (starting time of radiation release)

Entry (from left to right)	**Example** (always in English)	**Explanation**
Second line:		
Plane	**A**	Acquisition plane (on single plane systems: always **A**, on biplane systems **A** or **B**)
kV	**75kV**	Estimated tube voltage
mA	**171mA**	Estimated tube current
ms	**50.5ms**	Estimated pulse width
Control level	**10.0CL**	Estimated **C**ontrol **L**evel: coarse indication to estimate dose
Focus		Estimated focus size of x-ray tube
	micro	Micro focus (only for 3-focus tubes)
	small	Small focus
	large	Large focus
Copper filter	**0.1Cu**	Estimated copper filter
Zoom stage	**10cm**	Input size of I.I./FD
Area dose product*	**30.1µGym²**	Area dose product in µGy · m^2 of fluoroscopy/ acquisition calculated from the output of dose measuring device*
Skin dose*	**1.1mGy**	Calculated skin dose with respect to reference conditions
LAO/RAO angulation	**3LAO**	Lateral angulation angle (LAO/RAO)
cran/caud angulation	**0CRA**	Cranial/caudal angulation angle
Number of frames	**10F**	Total number of frames of the scene
Any	*****	If a value could not be determined, it is replaced by asterics.

* mandatory in the EU

Please note that for PERIVISION and DYNAVISION scenes *both* mask and fill run are recorded in *one* entry each.

Accumulated data

When the patient is being closed, i.e. another patient is registered, dose data is accumulated and added at the end of the examination protocol.

The following lines are added:

Entry (from left to right)	**Example** (always in English)	**Explanation**
First line:		
	*****Accumulated exposure data*****	
Date and time	**16-Mar-04 16:06:05**	Date and time of patient close
Second line:		
Physician	**Phys: ...**	Name of performing physician
Number of acquisitions	**Exposures: 2**	Total number of acquisitions (in both planes on biplane systems)
Fluoro time	**Fluoro: 1.1min**	Total fluoroscopy time (in both planes on biplane systems)
	Total:	
Area dose product*	**62.1Gym²**	Total area dose product in µGy · m^2 of fluoroscopy/acquisitions calculated from the output of dose measuring device*
Skin dose*	**5.6mGy**	Total calculated skin dose with respect to reference conditions
Third and fourth line (only on biplane systems):		
Plane	**A**	Acquisition plane A (floor stand)
	B	Acquisition plane B (top stand)
Fluoroscopy	**Fluoro: 0.1min**	Total fluoroscopy time in this plane
Area dose product*	**8.9µGym²**	Total area dose product in µGy · m^2 of fluoroscopy in this plane
Skin dose*	**0.3mGy**	Total calculated skin dose of fluoroscopy in this plane
	Total:	
Area dose product*	**52.7µGym²**	Total area dose product in µGy · m^2 of acquisitions in this plane
Skin dose*	**1.7mGy**	Total calculated skin dose of acquisitions in this plane

* mandatory in the EU

The dose values displayed in the **Exam Protocol** can be used to monitor the course of the examination. However, they cannot be used to calculate the applied patient dose!

The displayed dose area product* (µGy · m^2) has a tolerance of ±25% according to DIN 6819. If a fault in a system component occurs during the examination, it can result in incorrect entries in the Exam Protocol. In such a case, data could be incorrect or incomplete and should not be used for normal report generation. Siemens accepts no warranty or liability for the loss of this information and data.

All liability for consequential damage is excluded!

* mandatory in the EU

Please note that on the **Examination** task cards for plane A and B the accumulated fluoroscopic time (hours : minutes : seconds) is displayed for *both* planes. The **Exam Protocol** shows the values *for both planes separately*.

Depending on the problem, fluoroscopy times during "BYPASS FLUORO" might not be recorded in the **Exam Protocol**.

Comments If any comments have been entered (see below), they are added as separate lines.

Please note that due to compatibility reasons, it is not possible to have special characters in the examination protocol.

Some special characters, e.g. the Euro sign € and all Japanese* characters are converted to question marks **?**.

- Do *not* enter special or Japanese* characters in comments to **Exam Protocol** or in names of acquisition programs.

* applies to the Japanese version only

Entering comments

Additional information (e.g. contrast medium, medication) can be entered in the input field as follows:

- Enter the text.
- Click on **Append**.
  – The text is dealt with as an "event" and is appended to the end of the Exam Protocol.

The automatically registered entries and appended comments *cannot be* changed.

Printing the Exam Protocol

If a printer is installed for your system, you can print the Exam Protocol:

- Click on **Print**.
  – The Exam Protocols of the selected patient are sent to the default printer.

Depending on the number of scenes, the printout might extend across several US Letter (or DIN A4) pages. The page number and total number of pages are stated.

The patient identification is at the top of each page - the "header". This is followed by the list of scenes, comments, and stopwatch events. The "events" are arranged chronologically.

Closing the window

- Click on this icon or on **Close**.

If you have not added your comments to the **Exam Protocol** with **Append**, they will be deleted when you close the window.

Automatic storage

When you perform postprocessing functions, changes are always stored automatically. At the next review of a scene/image, you will find it in the last working state.

Storing the current image (Store Monitor)

You can store any image which is being currently displayed, including text and graphic information, as a new "acquisition" (**Store Monitor**), for example, if this image contains precisely the information you require for a diagnosis.

Store Monitor images can be used, for example, to send subtracted images via network, to view them e.g. on an Acom PC lite.

You can store a maximum of 256 **Store Monitor** *images per examination and plane .*

At the system console

- Click on this icon (of the required plane).

At the touchscreen control

- Activate the required plane.

- Activate **Store Monitor** (to the left of the card stack).

The current image is stored as "Store Monitor" on series/image level.

Only the image of the active plane is stored.
The shutter is not saved.

Documenting scenes/images

Filming and printing images

Use the **Image Text Editor** in the Configuration Panel (**Options > Configuration** in the main menu) to configure the text you would like to display on filmed or printed images.

⇨ For more information on **Filming**, please refer to the *syngo* ® documentation.

Filming/printing an image

You can expose on film or print on paper each displayed image:

❏ each image displayed in blow-up mode

❏ each scene representative, each reference image, each Store Monitor image in the scene directory

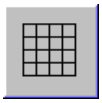
❏ each single image of a scene in the image directory (4x4)

Selecting scenes from the scene directory

◆ Pick the required display from the selection list.

⇨ Chapter **Managing and Viewing Scenes/Images**, "The scene directory of a patient"

Selecting images from the image directory



◆ Click on the 4x4 icon on the **View** subtask card.

⇨ Chapter **Managing and Viewing Scenes/Images**, "The image directory of a scene"

Selecting all objects

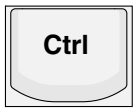
◆ Click on the first object.

◆ Press the **Shift** key.

◆ Scroll to the last object and click on it.

Selecting a series of objects

- Click on the first object.



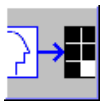
- Press the **Ctrl** key and click on additional objects.

Copying an image to film sheet

From the **Patient Browser**, you can only transfer individual images, i.e. **Store Monitor**, reference or single images, to the virtual film sheet.
From a task card, only the frame of a scene which is displayed on the monitor is being transferred to the virtual film sheet.

At the system console

If you want to film the image being currently displayed:



- Click on this icon in the control area.

If you want to film an image from the **Patient Browser**, please click the icon in the tool bar of the **Patient Browser**.

At the touchscreen control

- Activate **Copy to filmsheet**.

The selected images are transferred to the virtual filmsheet and displayed in the preset film format there.

You cannot window DSA images on the **Filming** task card.

- Window the scenes first on the **PostProc** task card.

Film preview

At the system console

- Click on this icon.
  – The **Film Preview** appears.

Archiving/sending/exporting an image/scene

It is possible to write an image viewer on CD-R.

Please ask Siemens service for configuration.

It is possible to process the scenes/images to be transferred to the capabilities of the target system: **Ready Processed Images**. *This means, that image format (e.g. downsizing), grey scale information (LUT), DSA processing (e.g. pixelshift), edge enhancement, windowing, zoom/pan and shutter can be adopted to the capabilities of each network node and CD-R separately.*

Please ask Siemens service for configuration.

There are statutory regulations governing the archiving period, data availability, and data security, and recommendations concerning fire protection or water damage for the archiving of image data.
The operator of the archive is responsible for observing these requirements.

Because of constantly advancing technical developments, it might not be possible to implement storage and access for the required archiving period with a single storage technology and type of medium. Migration of the data will therefore be necessary to a greater or lesser degree under the responsibility of the operator of the digital archive.

Via the **Transfer Configuration** in the configuration panel (**Options > Configuration** in the main menu), you can configure destinations for sending and exporting and set automatic sending/exporting.

❏ If you are sending / exporting to ACOM, set **Lossless JPEG**.

❏ For sending / exporting to *syngo* ® products, set **Compression: None**.

Automatic sending should only be set for *syngo* ® products.

Please note that an auto transfer rule consisting of: "Don't care" + "Received" + "Series" or "Studies" will *not* result in an auto transfer.
Workaround is to change the rule to: "Don't care" + "Received" + "Images"

Please note that most cardiac networks and viewing stations only permit processing/viewing with 512^2/8-bit image display!

It is not possible to send multiframe objects (DSA scenes) above a limit of about 70 images in a 1024x1024 matrix or about 600 images in a 512x512 matrix to workstations of the MagicView family.

Please note that the zoom and inversion settings are not included in the information transferred.
If you want the image to be displayed the same way at the receiving end, it is advisable to save it with **Store Monitor** and then transfer this image (as well).

Caution

Compression method is set to irreversible compression (**Lossy JPEG**)

The resulting images are no longer completely identical to the original images. Information of medical relevance may be lost.

- Lossy compressed images should not be used for primary diagnosis, the image quality may not be sufficient.

Caution

Transfer of images is set to downsize method.

Image information is reduced.

- It is the responsibility of the user to decide whether the reduced image information is sufficient for diagnostic purposes.

Always check that jobs are performed correctly. Check that jobs have reached their recipient complete.
In the event of an error (e.g. a network error), this may result in loss of data.

If patient or study transfer jobs were started from the **Patient Browser**, only one job may display an error message.
(That is the **Exam Protocol** that cannot be received by non-*syngo* ® systems and by ACOM.net only as from Version VB11A.)

⇨ For more information on **Archiving**, please refer to the *syngo* ® documentation.

Sending/archiving

◆ Click on this icon.

Or

◆ Click on this icon in the **Patient Browser**.

Or

◆ Select **Transfer > Send To...** or **Archive To**... from the main menu.
– A dialog box is displayed with the available target addresses in the network.

Selecting a destination and archiving/sending

◆ Select one or more destinations and click on **Send**/**Archive**.
– The image data will be sent to the selected address(es).

Inserting a CD-R

To minimize the risk of loss of data, only use media approved by Siemens and classified as 'medical' for archiving purposes.
Please ask your Siemens representative.
The AXIOM Artis systems were tested with CD media from Sony and TDK (650 MB, 700 MB). Do not use media from other manufacturers for storing / archiving because they have not been tested with the system.

Please note that it can appear that the capacity of a CD-R is not being used to the full because of the administration information that also has to be stored. This can occur especially when several patients with only a few images each are stored on a single CD-R.

◆ Insert an (empty) CD-R into the CD writer.

The first time you export data for a new CD-R, the **Enter Label** dialog box is displayed.

◆ Enter a *unique* name for the CD-R.

In case of an error, e.g. power loss, during multi session writing to CD-R, all data previously stored on that CD-R might get lost as well.
The software offers a service tool to restore the previous sessions.
Please ask Siemens service.

Do not open the CD tray manually to eject CDs. Use the **Eject from ...** command from the main menu instead.

Exporting/archiving

- Click on this icon in the **Patient Browser**.

Or

- Select **Transfer > Export To**... or **Archive To**... from the main menu.
  – A dialog box with the available archiving destinations appears.

Selecting a destination and exporting/archiving

- Select one or more destinations and click on **Export/Archive**.
  – The image data will be archived at the selected address(es).

Transferring 3D-DYNAVISION data for 3D reconstruction

⇨ You will find detailed information in the **InSpace Reconstruction** Operator Manual.

- Display the rotation series you want to transfer to the LEONARDO/*syngo* Workplace.

At the system console

- Select **Image > Send To 3D** from the main menu of the **PostProc** task card.

At the touchscreen control

- Activate **Send To 3D** on the **InSpace** task card.

Closing the patient

Always use the **Close Patient** function if an auto transfer rule is configured to send the completed study to another node.
If you don't do this, the exam protocol will not be transferred.

- Click on this icon.

Or

- Select **Patient > Close Patient** from the main menu.

– All monitors are flashed and a new emergency patient is registered.
– Depending on configuration, the **Patient Registration**, **Patient Browser** or **MPPS** window opens.

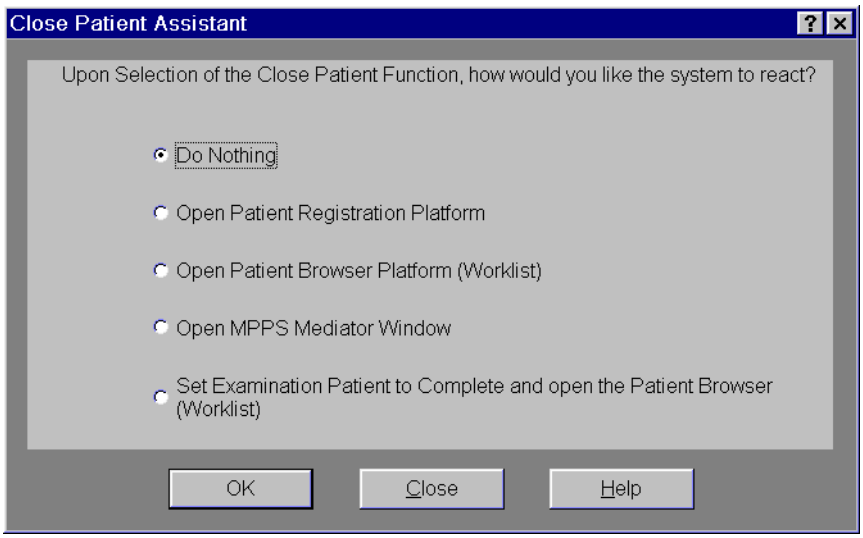
Configuring patient close

You can configure which action shall be performed when a patient is closed:

- ❏ None
- ❏ Open **Patient Registration** window
- ❏ Open **Patient Browser** window displaying the **Scheduler** (worklist)
- ❏ Open **Modality Performed Procedure Step** window
- ❏ Set examination patient to "completed" and open **Patient Browser** window displaying the **Scheduler** (worklist)

◆ Select **Options > Configuration** from the main menu.
– The **Configuration Panel** is displayed.

◆ Double-click the **Close Patient** icon.
– The **Close Patient Assistant** window appears.


Close Patient Assistant
Upon Selection of the Close Patient Function, how would you like the system to react?
Do Nothing
Open Patient Registration Platform
Open Patient Browser Platform (Worklist)
Open MPPS Mediator Window
Set Examination Patient to Complete and open the Patient Browser (Worklist)
OK
Close
Help

◆ Click on the required radio button.

◆ Confirm by clicking **OK**.

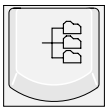
◆ Click **Close** to close the window.

Procedure tracking with MPPS

After completion of an examination and all associated evaluations, you can document the work you have done in a performance report. This report can then be used, for example, for invoicing the costs.

⇨ For more information on **MPPS**, please refer to the *syngo* ® documentation.

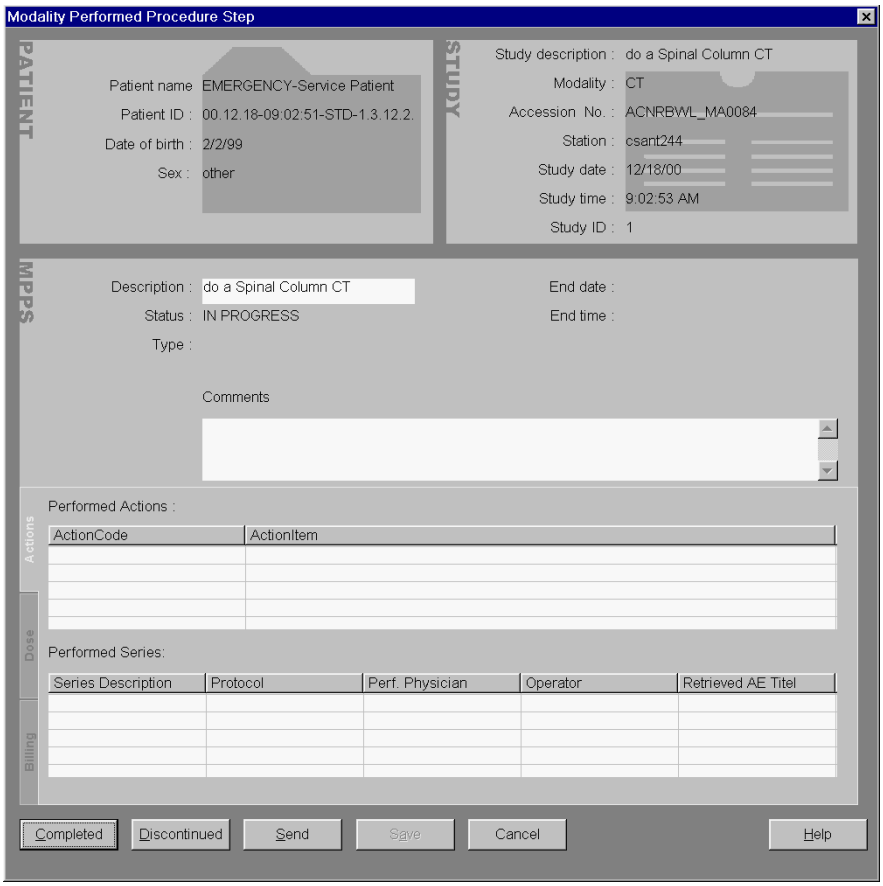
Editing the performance documentation



◆ Call up the **Patient Browser**.

◆ Select the patient, the examination, or one of the associated series or images.

◆ Click this icon on the toolbar.
– The window **Modality Performed Procedure Step** is displayed.



As soon as you select a series the field **Status** indicates the MPPS status.

Checking data

- ◆ Check the entries for the patient and examination in the areas **PATIENT**, **STUDY**, and **MPPS**.
- ◆ Correct the data and enter a comment, if necessary.

Displaying Actions, Dose, Billing

- ❑ On the **Actions** card, a list of the examination steps performed (Exam Protocol) is displayed.
- ❑ On the **Dose** card, a list of the data in connection with the radiation exposure (e.g. applied dose) is displayed.
- ❑ On the **Billing** card, cost-related statement of the services rendered and the materials consumed (film sheets) are displayed.
- ◆ Select data by clicking on the corresponding tab.

Sending and concluding a report

- ◆ Click on **Save** to save your changes to the report.
- ◆ Click on **Completed** to conclude the report and the examination.
- ◆ Click on **Discontinued** if you do not want to continue examination.
- ◆ Click on **Send** to mark the report as "in progress" and pass it on the HIS/RIS system.

Deleting patients/studies/series/scenes

It is not possible to delete patient data in the following cases:

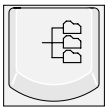
- ❏ Data is protected
- ❏ Data which is currently loaded in a task card
- ❏ Data has not the required work status
- ❏ Data which is temporally not available (because of an error)

Caution

Deletion confirmation deactivated

Loss of data possible

- ◆ Do not deactivate deletion confirmation in the **Configuration Panel**.



- ◆ Call up the **Patient Browser**.
- ◆ Select the object(s) to be deleted.
- ◆ Select **Edit > Delete** from the menu of the **Patient Browser** or open a popup menu (right mouse button) and select **Delete** there.

Or

- ◆ Click on this icon in the toolbar.

A dialog box appears in which you must confirm that you really want to delete the data you have selected.

- ◆ Confirm the question with **Yes** to delete the selected patient and examination data.

⇨ For more information on deleting using the **Patient Browser**, please refer to the *syngo* ® documentation.

Operator Manual
Exam Sets

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The Exam Set Editor

Introduction

The AXIOM Artis provides a number of acquisition, fluoroscopy and roadmap programs for standard examinations.

The acquisition, fluoroscopy and roadmap programs are arranged in *exam sets* and stored in a database. The fluoroscopy/acquisition parameters and dose are determined in the exam sets.

The available exam sets depend on the system type and the profile set.

The system comes preinstalled with a number of exam sets.

◆ For further information on the preinstalled examination sets ask your applications specialist.

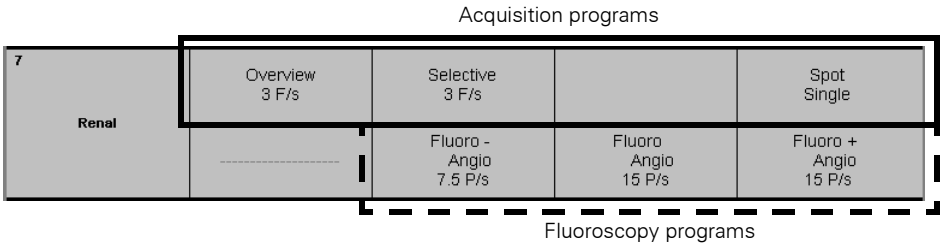
The programs may only be changed by experienced users.

Exam Sets

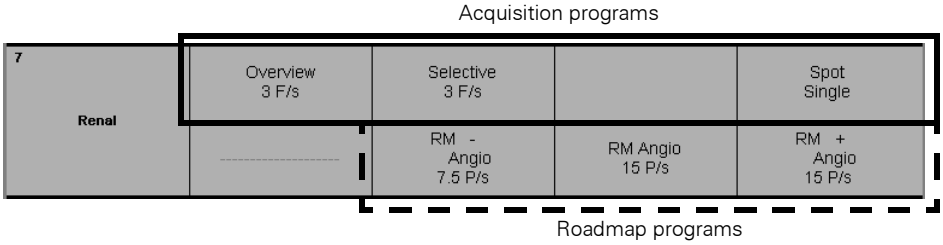
An exam set comprises

❏ 3 fluoroscopy programs and possibly
3 assigned roadmap programs, and

❏ up to 4 acquisition programs.



Example of exam set, view with fluoroscopy programs



Example of exam set, view with roadmap programs

The fluoroscopy/roadmap programs are always available in three versions, which usually differ with regard to their dose.

The first acquisition program should always be a DR or DSA program when performing a DR-Scanning, PERISTEPPING, PERIVISION, DR-DYNAVISION or DSA-DYNAVISION acquisition.

Current exam set

You can view and edit the acquisition/fluoroscopy/roadmap programs which are stored in the database and arranged in exam sets.

Every acquisition, fluoroscopy, or roadmap program is stored *once* in the system and can be used in *one or more* exam sets.

The exam sets on your system depend on the type of system and the profile set.

A number of exam sets are preinstalled on the system when it is delivered.

- Ask your application specialist for further information about preinstalled exam sets.

The settings of the current programs do not have to be the same as the settings of the programs stored in the database.

The values shown in the images are only explanatory. They have no clinical meaning.

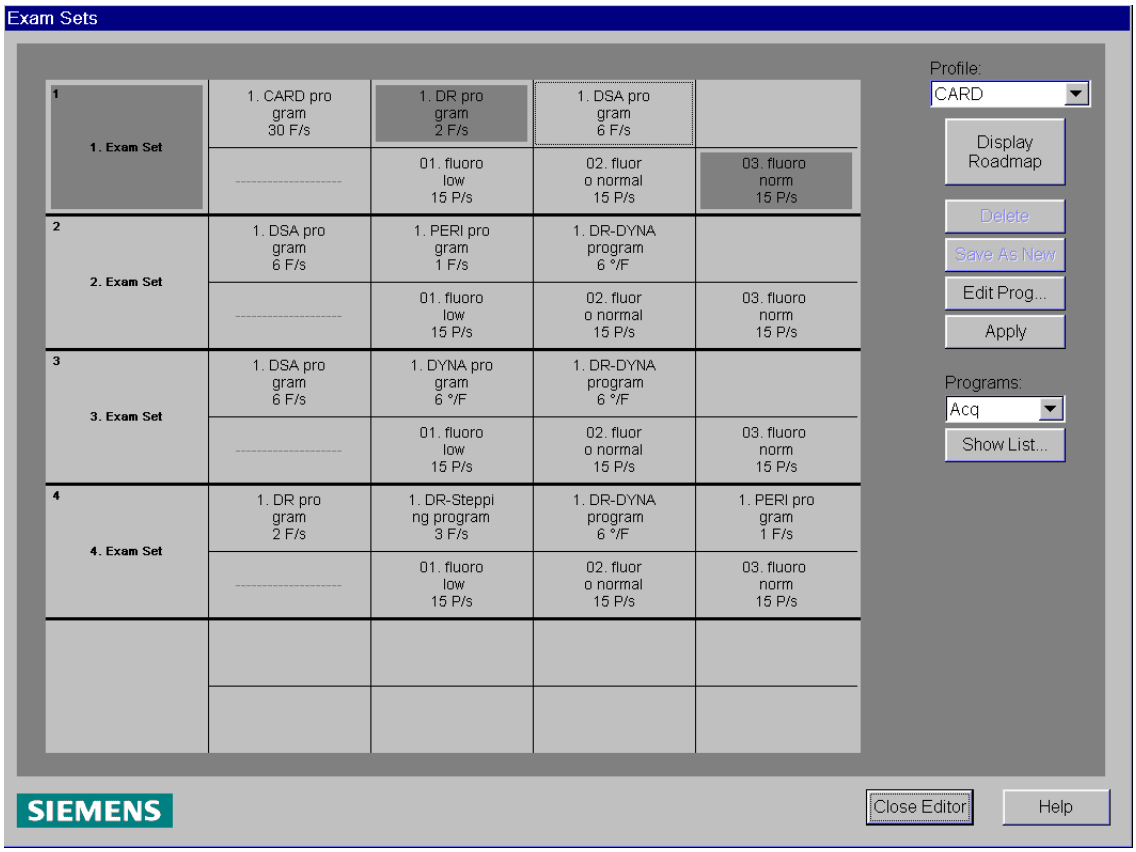
Managing and editing exam sets

You can edit existing exam sets, create new exam sets, and delete exam sets that are no longer used.

- Click on the Exam Set Editor icon on the **Examination** task card.

Or

- In the main menu select **Acquisition > Exam Set Editor...** .
  – The **Exam Sets** window appears.



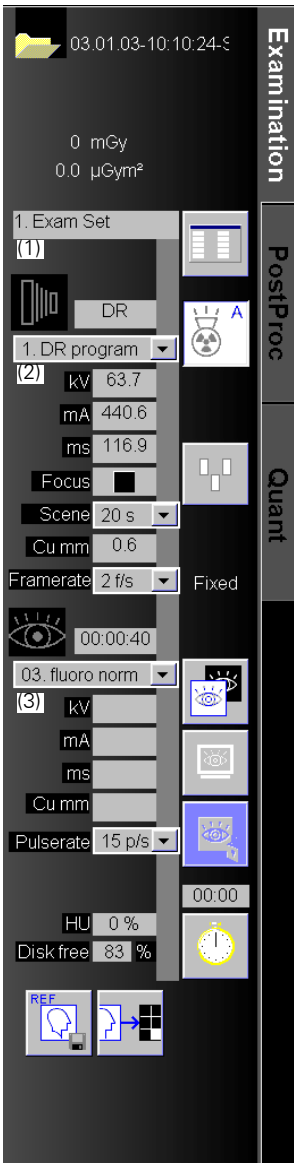
The Exam Set Editor with the fluoroscopy programs

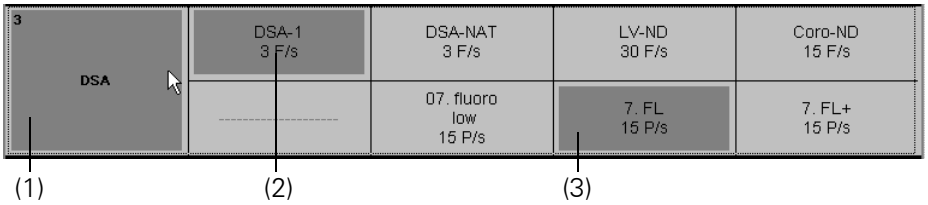
Viewing exam sets

After you have called up the Exam Set Editor, it will appear in the tabular view.

Active examination

The currently active exam set with the currently active acquisition and fluoroscopy programs is marked.





Example of active exam set, view with fluoroscopy programs

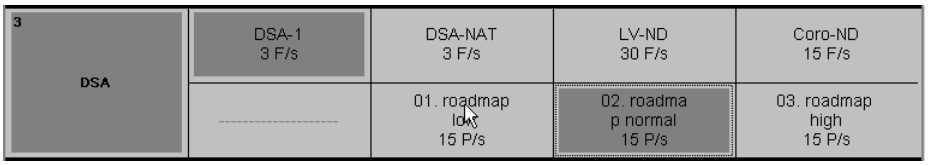
(1) active exam set

(2) active acquisition program

(3) active fluoroscopy program

Viewing roadmap programs

◆ Click on **Display Roadmap**.
– The roadmap programs are displayed instead of the fluoroscopy programs.



Example of active exam set, view with roadmap programs

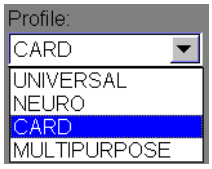
Displaying fluoroscopy programs again

◆ Click on **Display Roadmap** once again.
– The fluoroscopy programs are displayed again.

Displaying exam sets of a certain profile

Depending on the system configuration, you can make use of different types of exam sets:

- ❏ **UNIVERSAL**: for universal angiography
- ❏ **NEURO**: for neuroradiological examinations
- ❏ **CARD**: for cardiography
- ❏ **MULTIPURPOSE**: for multipurpose use



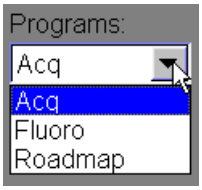
◆ Select the type of examination under **Profile**.
– The table with the exam sets is displayed at the location of the exam sets for the selected profile.

Only the installed profiles are displayed.

Displaying existing acquisition/fluoroscopy/roadmap programs

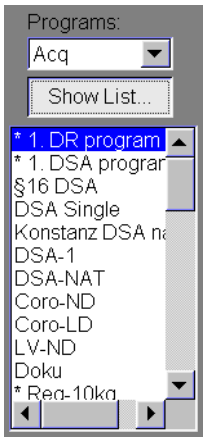
The **Programs** list gives you an overview of the acquisition/fluoroscopy/roadmap programs stored in the system.

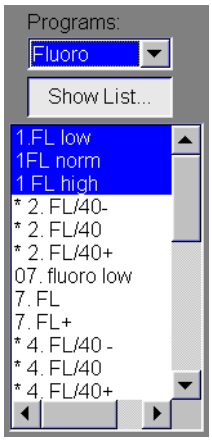
Viewing programs

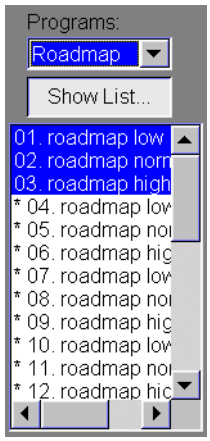


◆ Under **Programs** select whether acquisition, fluoroscopy, or roadmap programs should be displayed.

◆ Click on **Show List...** .
– A list of existing programs will be displayed.





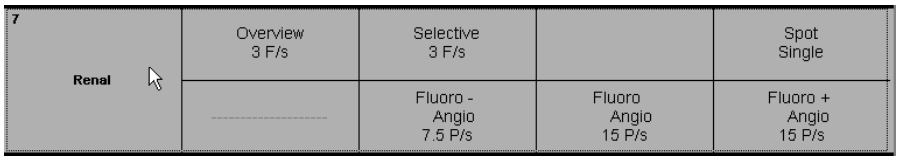


*If an acquisition/fluoroscopy/roadmap program is not used in any examination program, it is marked with an asterisk *.*

Editing exam sets

Marking an exam set

◆ Click on the required field in the left column.
– The exam set is marked with a dashed border.

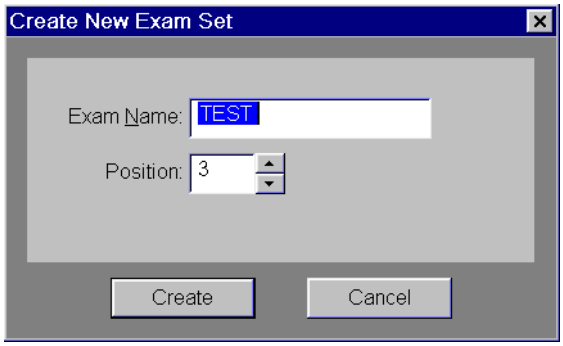


Creating a new exam set

To create a new exam set, always use an existing exam set which is as similar as possible to the exam set to be created.

- Mark the required exam set field (left column).

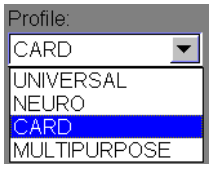
- Click on **Save As New**.



- Overwrite or change the existing name.
- Define the position of the new exam set in the table by entering a position number.
- Confirm with **Create**.
  – The new exam set will be inserted with the new name at the position you had entered.

Assigning an exam sets to a certain profile

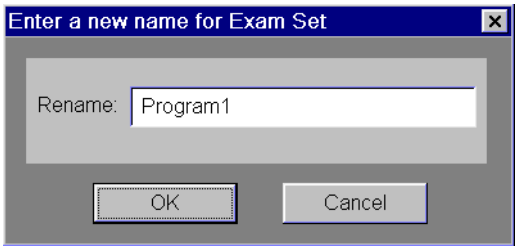
- Mark the required exam set field (left column).



- Select the type of examination under **Profile**.

Renaming an exam set

- Double-click on the required exam set.

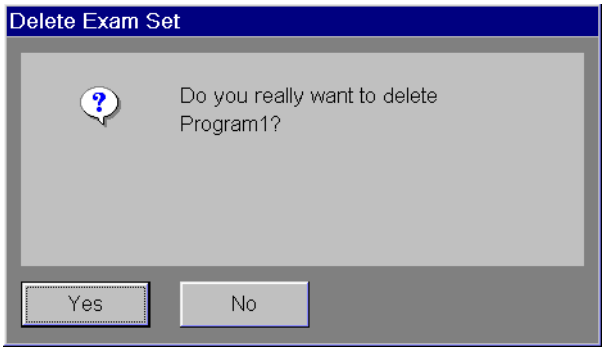


- Overwrite or change the existing name.
- Confirm with **OK**.
  – The name of the exam set will be changed.

Deleting an exam set

- Mark the required exam set field (left column).

- Click on **Delete**.



- If you want to delete the exam set, confirm with **Yes**.
  – The exam set will be irreversibly deleted.

It is not possible to delete the active exam set.

When you delete an exam set, the acquisition/fluoroscopy/roadmap programs used in it are not deleted.

Assigning acquisition/fluoroscopy/roadmap programs

You can assign arbitrary existing acquisition/fluoroscopy/roadmap programs to an existing or newly created exam set. The following rules apply:

- ❏ The *active* exam set cannot be selected as the source or destination.
- ❏ An acquisition program can be set only at the location of an acquisition program (first line of the exam set).
- ❏ A fluoroscopy program can be set only at the location of a fluoroscopy program (second line of the exam set, if **Display Roadmap** *is not selected*).
- ❏ A roadmap program can be set only at the location of a roadmap program (second line of the exam set, if **Display Roadmap** *is selected*).

In an exam set, the second (middle) fluoroscopy program is always the normal fluoroscopy program.

Continuous fluoroscopy is *not* available in FD systems.
Exception: In BYPASS FLUORO mode, e.g. UPS operation.

Do not copy FLUORO programs with continuous fluoroscopy in biplane systems.

- ◆ Use *only* programs with *pulsed* fluoroscopy in biplane systems.

Storage Changes in exam sets are automatically saved but not applied to the current examination.

Assigning programs with Drag&Drop

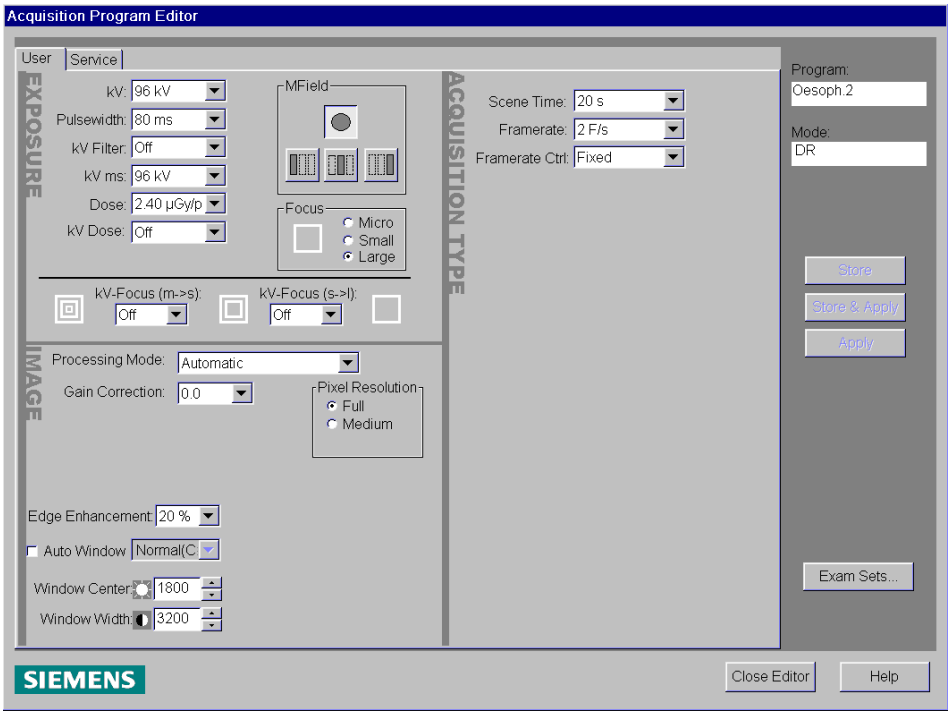
- ◆ Click on the required acquisition/fluoroscopy/roadmap program in a field of the table or in the **Programs** list, keep the mouse button pressed, drag it to the required location, and release the mouse button there.
  – The acquisition/fluoroscopy/roadmap program is copied to the new location.

Viewing and editing acquisition/fluoroscopy/roadmap programs

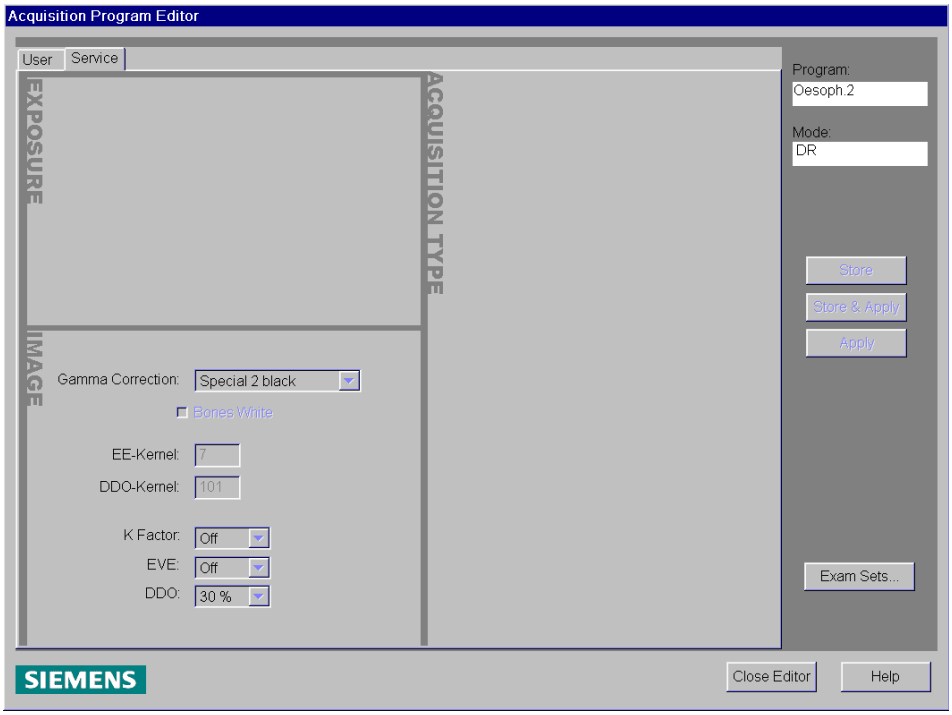
To view the parameters of an acquisition/fluoroscopy/roadmap program and to change the program, first select the acquisition/fluoroscopy/roadmap program in the Exam Set Editor and then switch over to the editor view:

- Mark the required acquisition/fluoroscopy/roadmap program with a mouse click.
  – The field is marked with a dashed border.

- Click on **Edit Prog...** .
  – The parameters of the acquisition/fluoroscopy/roadmap program are displayed.



Example of an acquisition program: user parameters



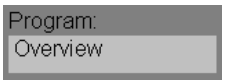
Example of an acquisition program: service parameters (display only)

Switching back to the exam sets

- Click on **Exam Sets...** .
  – The table with the exam sets is displayed again.

Name of an acquisition/fluoroscopy/roadmap program

The current name of the acquisition/fluoroscopy/roadmap program is shown in the top right corner.



Changing the name

Please do not include laterality in acquisition program names. This can confuse.

- Overwrite or change the name as required.

Changing parameters

⇨ Chapter **Parameters for Exam Sets**.

Storing and/or applying acquisition/fluoroscopy/roadmap programs

If you have changed an acquisition/fluoroscopy/roadmap program, you can store changes in the database or apply the settings to the current examination or both.

In each acquisition mode (DR, DSA, DYNA, PERI), 50 acquisition programs can be stored.
When this amount is reached and you want to create another one, you must delete acqisition programs not required anymore.

⇨ "Deleting an acquisition/fluoroscopy/roadmap program" on page 16

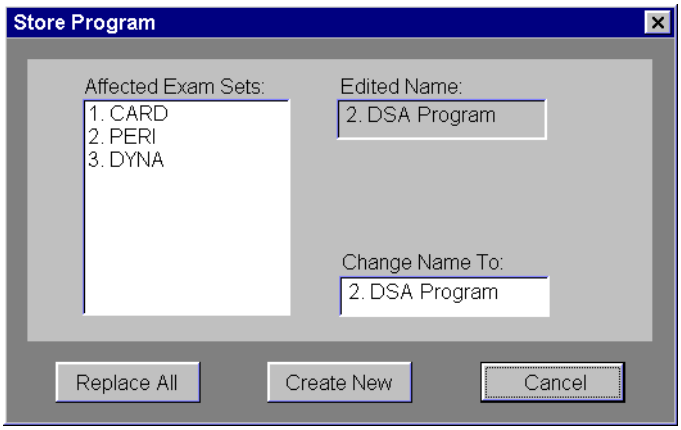
Storing a program

You can only select **Store** in a program if parameters have been changed (but not if only the name has been changed).

◆ Click on **Store**.

❑ If no program with the name of the new program exists, changes are stored in the exam set database.

❑ If a program with the name of the new program already exists, a dialog box appears.



Accepting the changes for all exam sets

- Click on **Replace All**.
  – The acquisition/fluoroscopy/roadmap program is transferred to the exam set database with the new settings.

Creating a new program

- Enter a new name or overwrite the existing name.
- Click on **Create New**.
  – A new program is created and assigned to the exam set but not applied to the current examination.

Applying a program

- Click on **Apply**.
  – Changes are applied to the current examination but not stored in the exam set database.

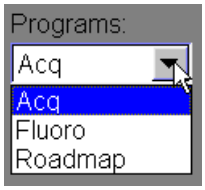
Storing and applying a program

- Click on **Store & Apply**.
  – Your changes are stored in the exam set database and applied to the current examination.
  – The Exam Set Editor is closed.

Deleting an acquisition/fluoroscopy/roadmap program

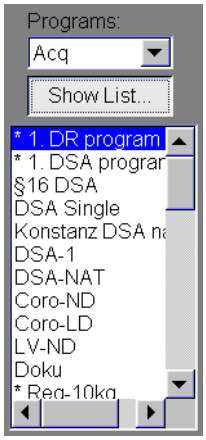
If an acquisition/fluoroscopy/roadmap program is not used in any exam set, you can delete it.

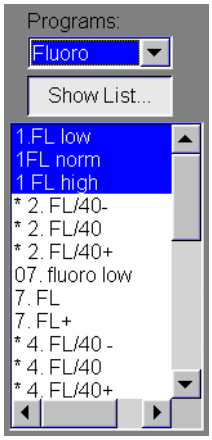
- If necessary, switch to the exam sets by clicking on **Exam Sets...**.

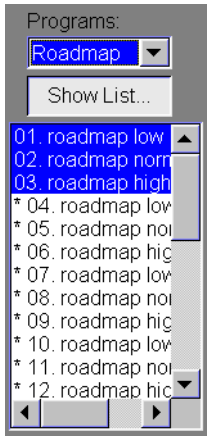


- Under **Programs** select whether acquisition, fluoroscopy, or roadmap programs should be displayed.

- Click on **Show List...** .
  – A list of existing programs will be displayed.





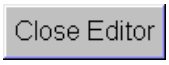


If an acquisition/fluoroscopy/roadmap program is not used in any examination program, it is marked with an asterisk *. In that case you can delete it:

- Click on the program to be deleted.

- Click on **Delete Acq**.

Closing the Exam Set Editor



- Click on **Close**.
  – If you have made changes, a dialog box appears asking you if you want to save them.
- Confirm as required.

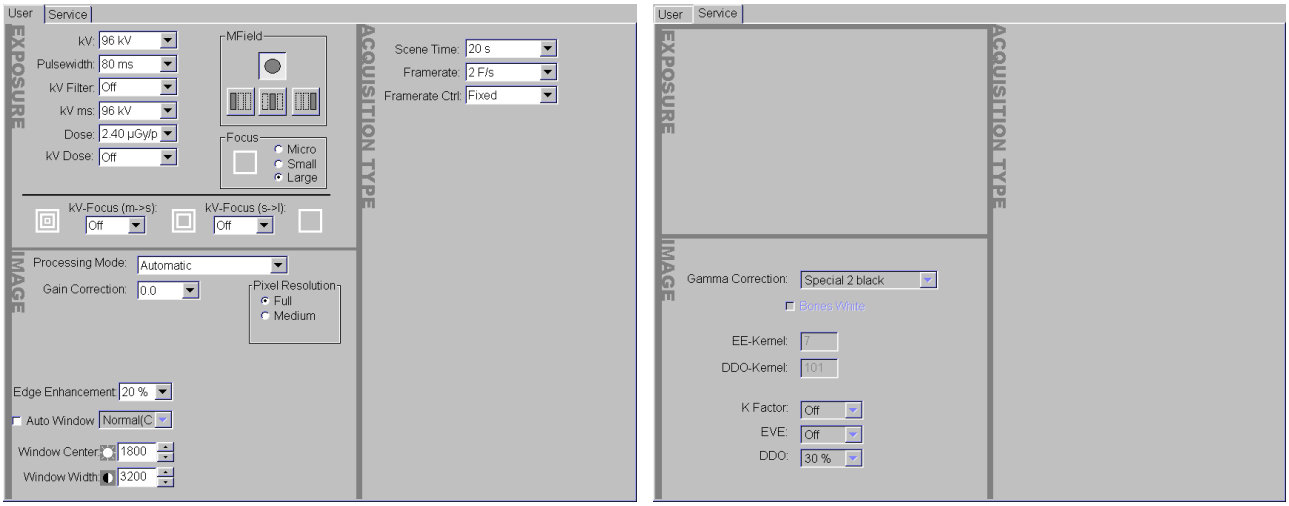
Parameters for Exam Sets

The parameters for the acquisition/fluoroscopy/roadmap programs are arranged in groups in the **Acquisition Program Editor** or **Fluoro Program Editor**.

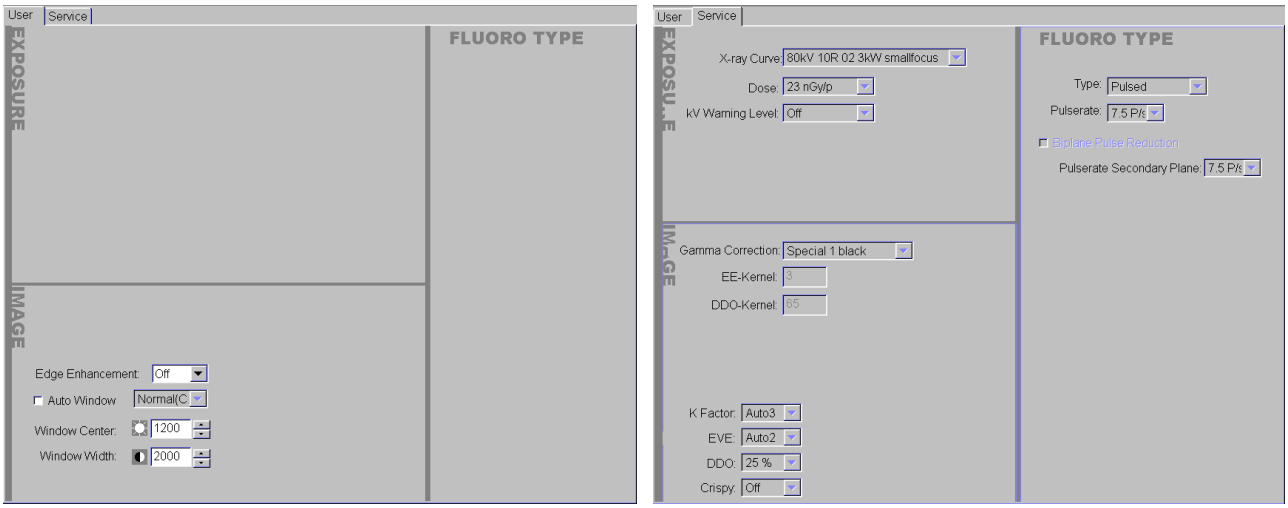
Each program is divided in two sets of parameters arranged on subtask cards:

- ❏ On the **User** subtask card, you can edit parameters which apply to the selected acquisition/fluoroscopy/roadmap program.
- ❏ On the **Service** subtask card, parameters essetial for image quality are displayed. These parameters can only be set in service mode.

The available parameters depend on the system configuration and the program.



Parameters for acquisition program (example)



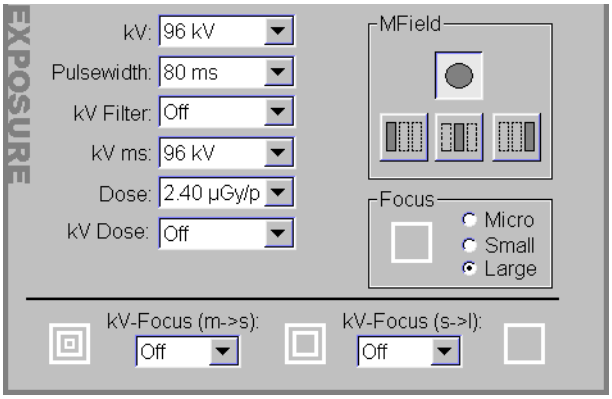
Parameters for fluoroscopy program (example)

Acquisition parameters

Radiation parameters

Generator settings

You can define the settings for radiation generation in the **EXPOSURE** area.



Exposure parameters (example)

kV

Tube voltage in kV (kV plateau)
for iodine contrast approximately 70 kV.

The set **kV** value is maintained automatically for as long as possible. For extremely thin or small objects, the kV value is reduced. In case of lower transparency, the kV value is increased. This ensures correct image brightness.

If **kV Filter** is also set to a value between 40 kV and 125 kV (see below), then, depending on patient transparency, a filter is automatically placed in the beam to reduce the patient dose. To maintain (the relative) contrast, the nominal kV value is reduced in accordance with the filter thickness.

Example

kV plateau set to 70 kV, kV filter set to 81 kV

With increasing patient thickness and/or density, the following values will be set:

60 kV / 0.9 mm Cu
63 kV / 0.6 mm Cu
65 kV / 0.3 mm Cu
66 kV / 0.2 mm Cu
68 - 81 kV / 0.1 mm Cu
>81 kV / 0 mm Cu

AC1 - AC2
(not with CARD)

Depending on the examination, you can configure a kV curve (AC 1 - AC 6) instead of maintaining the kV value at a certain plateau for a wide transparency range. If you use this curve, the kV value will increase slightly with an increasing patient size.

Pulsewidth Pulse width in ms

Maximum required pulse width in milliseconds, depending upon the patient transparency which is determined during fluoroscopy.

This value will be adapted to the patient transparency to ensure correct image brightness. For a configurable **kV ms** value, e.g. 102 kV ms, the ms value is increased by up to 60% for the same kV rather than increasing the kV value.

The automatic increase in the ms value is 60%, but not more than the maximum pulse width set in the acquisition program (which depends on the frame rate).

fixed 266 ms (not with CARD) If you select this value, a pulse width of 266 ms will be maintained irrespective of the patient transparency.

This keeps the noise down during examinations with very low contrast and little patient movement, e.g. DSA for lower extremities, intravenous examinations, and CO_2 examinations, where a long exposure time helps to smear out CO_2 gas bubbles in vessels.

kV Filter kV value at which the copper prefilter is moved out of the beam path.

⇨ See also **kV**

If **kV Filter** is set to a value between 40 kV and 125 kV, an additional filter will automatically be placed in the beam irrespective of the patient transparency.

As soon as the **kV** value is about to rise above the configured kV plateau, the filters are removed - except for the 0.1 mm Cu filter which remains in the beam until the set **kV Filter** value (e.g. 81 kV) is reached.

If **kV Filter** is set to **Off**, no additional filters will be placed in the beam regardless of patient transparency.

The system automatically selects a filter between 0.1 and 0.9

For pediatric examinations, we recommend to use a fixed **kV Filter** = **125 kV**.

In this way, at least 0.1 mm Cu is always inserted.

For fluoroscopy, at least 0.2 mm Cu is mandatory.

kV ms kV value at which the pulse width is switched over.

⇨ See **Pulsewidth**

Dose Dose per image

The dose entered is a nominal value in µGy which applies to the measuring conditions at 70 kV, 2.1 mm Cu prefiltering, 16 cm FD input field.

With a large FD input field, the dose is reduced automatically, and with a small input field it is increased automatically.

kV Dose kV value at which the dose is switched over for dose reduction.

The **kV** value increases depending on patient thickness and/or density. For image quality reasons, especially for examinations with iodine contrast and kV values of 96 kV to 102 kV, we recommend keeping the kV value constant and reducing the dose instead (more noise). Increasing the kV value always results in loss of image contrast.

If **kV Dose** is set to **Off**, no dose reduction at a certain kV will be performed.

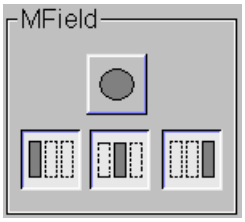
Correction Iris correction

The density correction allows you to change the strength of the video signal by changing the opening of the iris in steps of 1/2 exposure points (approx. 10%). This changes the image appearance.

- ❏ Negative values help avoid image saturation, e.g. with Pulmonalis-DSA, but also cause more noise.
- ❏ Positive values increase the contrast for homogeneous objects, e.g. with DSA, but tend to cause image saturation.

Correction has no impact on the dose.

MField Measuring field(s) (dominants) in which the applied dose is measured.

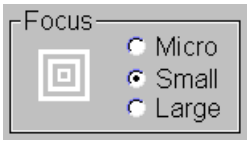


The size and position of the measuring field used for automatic dose control (ADC) and automatic gain control (AGC) of the video signal.

The measuring field or a combination of measuring fields must be selected depending on the object to be examined. It should always be in line with the object of interest.

On systems with an FD 20x20 flat detector, only the center measuring field is available.
In CARD programs, the center measuring field is preset and cannot be changed.

Focus Focus size of the X-ray tube



- ❏ Micro focus (only for 3-focus tubes)
- ❏ Small focus
- ❏ Large focus

or automatic focus selection

The smaller the focal spot, the sharper the image. However, because of a small focal spot, the load capacity of the tube is reduced, which causes the kV to increase with an increasing object thickness and/or density.

The automatic focus selection always sets the smallest possible focus. The system switches over to the next larger focus only if the automatic exposure control requires this, e.g. to keep the kV low.

kV-Focus kV value at which switching from a smaller to a larger focus occurs.

- **kV focus (m-->s)**: kV value at which switching from a micro focus to a small focus occurs (with a 3-focus tube only)
- **kV focus (s-->l)**: kV value at which switching from a small to a large focus occurs.

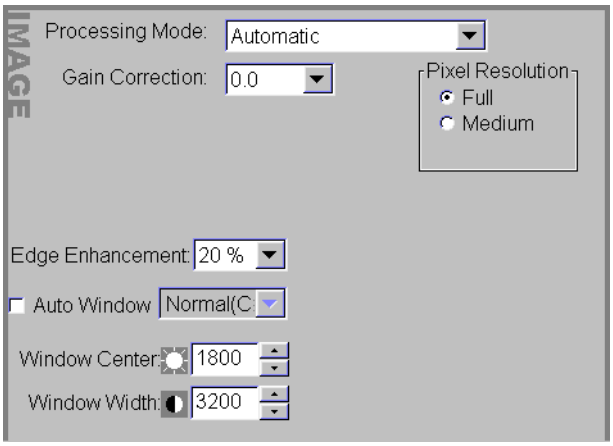
Only available if **Focus auto** is selected.

The smaller focus will be maintained until the configured kV level is reached. If the patient transparency requires a higher kV, the focal spot will automatically switch to the next highest focus to maintain the image contrast (kV). This results in a loss of resolution.

If **kV Focus** is set to **Off**, only the selected focus is used.

Image parameters for acquisition

You can define further settings for image processing and image display in the **IMAGE** area.



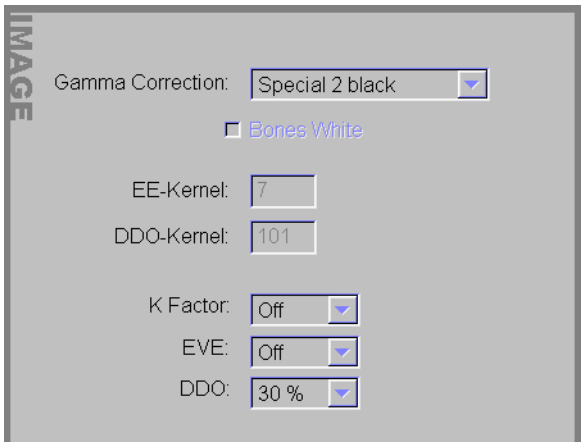
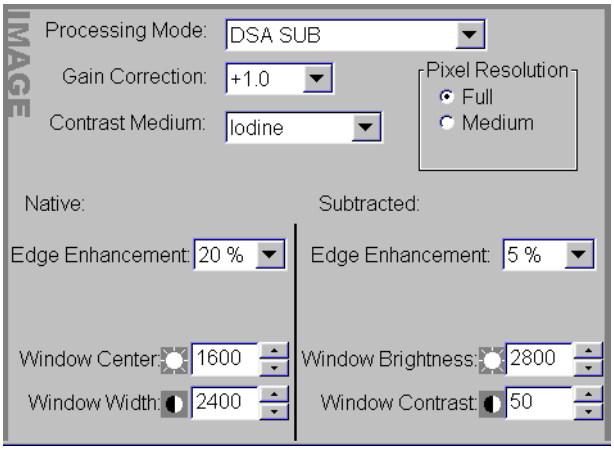


Image parameters for non-subtracted acquisitions (example)



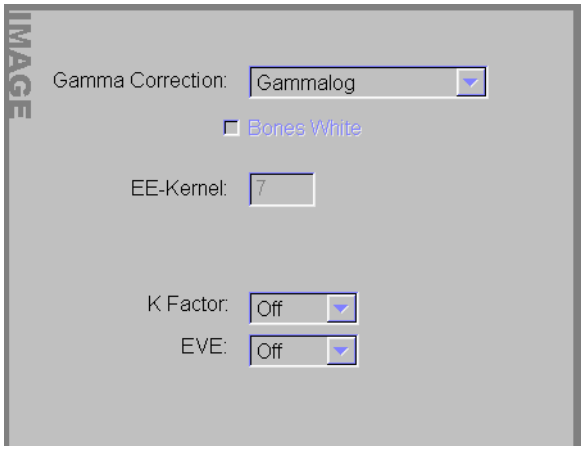


Image parameters for DSA acquisitions (example)

User parameters

Processing Mode Exposure control and display mode for observation

- **Automatic**:
  with exposure control (automatic adjustment to object transparency)
- **Regulation Stop**:
  stops exposure regulation after a fixed time (e.g. for left ventricular cardiac examinations)
- **DSA NAT**:
  non-subtracted display
- **DSA SUB**:
  subtracted display

Gain Correction Radition correction in Siemens exposure points

Contrast Medium Contrast medium used (for DSA acquisition only)

- **None**
- **CO_2**
- **Iodine**
- **Gadolinium**
- **Barium**

This setting influences the max/min OPAC function in postprocessing:

- ❏ For iodine, the darkest gray-scale values are used.
- ❏ For CO_2, the brightest gray-scale values are used.

Pixel Resolution Selection of pixel resolution (matrix size) on FD systems.

- ❏ **Full**
- ❏ **Medium**
- ❏ **Low**

Except for DYNAVISION programs, this choice is only displayed if the 2K option is configured.

Pixel resolution is not available for CARD programs.

Native / Subtracted Parameters for non-subtracted and subtracted (DSA) acquisition

Edge Enhancement Set edge enhancement

Edge enhancement results in a clearer display of contrast differences (vessel edges). However, this also causes more noise as image noise is also displayed more clearly due to the edge enhancement.

Auto Window Manual or automatic windowing

Automatic windowing occurs on the basis of a histogram analysis. This allows contrast enhancement for images with more homogeneous content.

Auto Window is only possible for non-subtracted images.

The maximum contrast enhancement can be configured by Siemens Service.

	Window Center **Window Brightness**	Pre-setting for window center (non-subtracted) Pre-setting for brightness (subtracted)
	Window Width **Window Contrast**	Pre-setting for window width (non-subtracted) Pre-setting for contrast (subtracted)

Service parameters

Gamma Correction Brightness curve correction for acquisition

Bones White If this parameter is activated, the image is always inverted (Bones White).

A non-inverted image shows the contrast medium dark against a bright background, whereas an inverted image shows the contrast medium bright against a dark background.

EE-Kernel Kernel for edge enhancement algorithm

DDO-Kernel Kernel for DDO algorithm

K Factor Image averaging over time

⇨ "K Factor and motion detector" on page 38

EVE Extended Vessel Enhancement

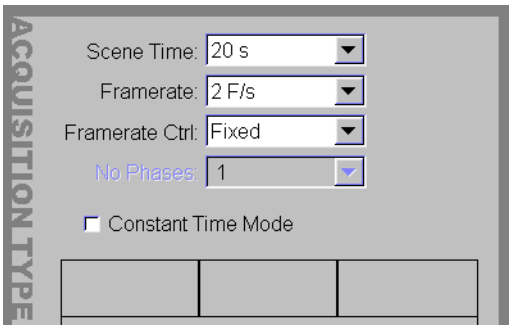
Algorithm which emphasizes vessel edges. It works on a static image after changes of **K Factor**.

DDO **D**igital **D**ensity **O**ptimization

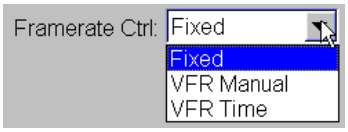
⇨ "Digital density optimization (DDO)" on page 39

Frame rates and scene duration

In the **ACQUISITION TYPE** area, you can define the settings for the frame rates and the duration of individual scenes for different organs and examinations.



Framerate Ctrl.



◆ Select one of the following possibilities under **Framerate Ctrl**:

❏ **Fixed**
A *constant* frame rate is selected for the *entire* duration of the scene.

❏ **VFR Manual** (variable frame rate, manual)
Different frame rates (*and breaks*) can be selected for *several phases* of a scene. The scene is advanced *manually* using the mode-dependent function key on the manual release switch.

❏ **VFR Time** (variable frame rate, time-controlled)
Different frame rates (*and breaks*) can be selected for *several phases* of a scene. However, the scene is *automatically* advanced after the preset *time intervals* elapse.

❏ **Scan Slow** (only in Artis dMP)
DR-Scanning with slow movement

❏ **Scan Fast** (only in Artis dMP)
DR-Scanning with fast movement

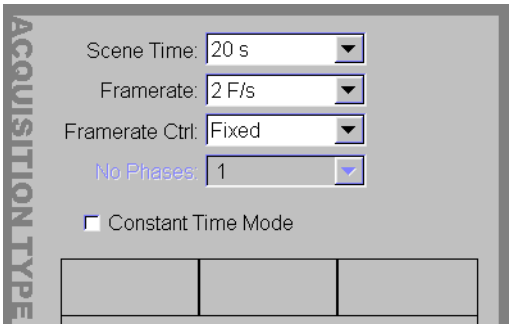
The scan speed can be set by Siemens Service.

The display changes depending upon the setting selected.

Fixed frame rate

With this setting, the frame rate remains constant during the entire scene.

Framerate Ctrl. **Fixed**



Scene Time Maximum duration of the scene in seconds

You can end (interrupt) the scene before this time has elapsed by releasing the exposure release button.

Framerate Frame rate (frames per second)

Depending upon the settings selected, the system determines the optimum load curve for the X-ray tube as well as the storage space required.

With PERISTEPPING or PERIVISION, the frame rate can be set separately for each step.

A reduced frame rate helps reduce the radiation load on the patient and personnel!

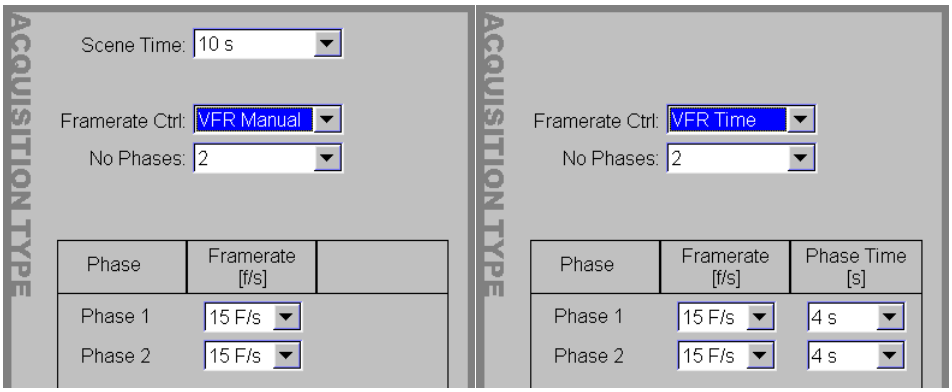
Constant Time Mode Electronic noise reduction by averaging,
only for 0.5; 1; 2 F/s DR/DSA

The image appearance is improved by averaging several images (4 images) while keeping the dose constant. Disadvantage: Motion blurring

Variable frame rate

With a variable frame rate, a scene is subdivided into phases of different lengths. Manual or time-controlled advancement is possible.

Framerate Ctrl. **VFR Manual/Time**



Scene Time Maximum duration of the scene in seconds (with **VFR Manual** only)

No. Phases Number of phases with variable frame rate

Phase # - Framerate Frame rate (frames per second) in Phase No. #

Phase # - Phase Time Duration of the Phase No. # in seconds (with **VFR Time** only)

Possible frame rates Depending on the highest selected frame rate, only certain image rates may be selected.

These must be the highest selected frame rate divided by an integer.

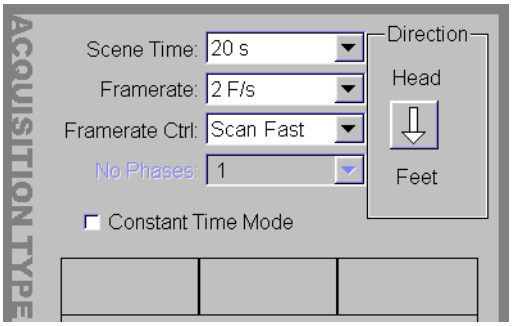
Example:
7.5 / 4 / 2 / 1 / 0.5 f/s (displayed frame rates)
7.5/3.75/1.88/0.94/0.47 f/s (technical frame rates)

Only the following combinations is possible:
60 / 30 / 15 / 7.5 / 4 / 2 / 1 / 0.5 / Pause

DR-Scanning (Artis dMP only)

DR-Scanning is activated with this setting.

Framerate Ctrl. **Scan: Slow/Fast**



Frame rates for DR-Scanning (example)

Scene Time Maximum duration of the scene in seconds

You can end (interrupt) the scene before this time has elapsed by releasing the exposure release button.

Framerate Frame rate (frames per second)

⇨ "Fixed frame rate" on page 27

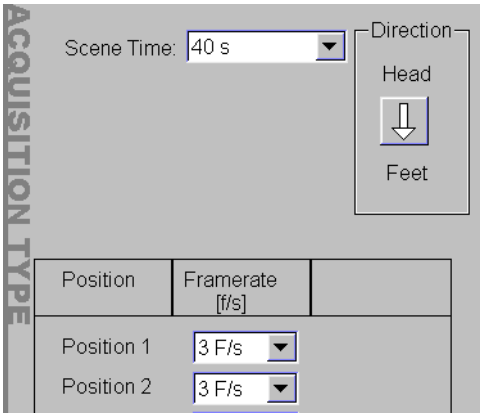
Direction The running direction of a DR-Scanning run can be selected according to the region to be examined, normally from thick to thin.

- ❏ **Head → Feet**
- ❏ **Head ← Feet**

The running direction always refers to the patient position.

Frame rates for stepping mode

As in the case of variable frame rate, PERISTEPPING and PERIVISION programs are also used to divide a scene into phases of different lengths. Manual or automatic step advancement is possible.



Frame rates for PERISTEPPING and PERIVISION (example)

Scene Time Maximum duration of the scene in seconds

With PERISTEPPING or PERIVISION, you can set the scene time for the entire procedure.

The step length of the unit can be set by Siemens Service.

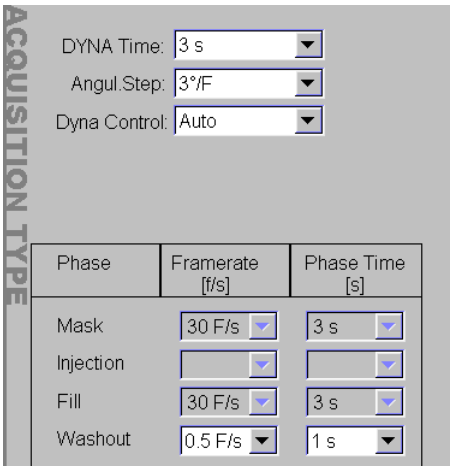
Direction In PERISTEPPING or PERIVISION, you can set the direction of the (mask and) fill phase:

- **Head** → **Feet**: arterial blood flow
  - With PERISTEPPING the scene runs toward the feet.
  - With PERIVISION the mask phase and the fill phase run toward the feet.
- **Head** ← **Feet**: venous blood flow
  - With PERISTEPPING the scene runs toward the head.
  - With PERIVISION the mask phase runs toward the feet, the fill phase toward the head.

The running direction always refers to the patient position.

Position # - Framerate Frame rate (frames per second) in Phase No. #

Frame rates for rotation angiography

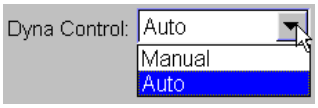


Frame rates for DYNAVISION (example)

DYNA Time Time in seconds required by the C-arm to drive the selected DYNAVISION angle of rotation.

Angul. Step Angulation step = DYNAVISION angulation step (°/F).

Dyna Control There are two possibilities for the control of a DR-DYNAVISION or DYNAVISION examination:



◆ Under **Dyna Control** select one of the following possibilities:

❑ **Auto**
Automatic injection means that at the end of the test run, injection starts automatically *and* the remaining procedure runs completely automatically, that is, on operation of the acquisition trigger, acquisition is started and injection, possibly a mask and filling run are then automatic.

❑ **Manual**
After the mask phase the C-arm returns to its starting position. The injection must be triggered *manually*. The C-arm *remains* in the starting position until the fill phase is triggered *manually* with the handswitch. Then the system will switch over to subtracted display, if applicable. If the fill phase is not triggered manually, it starts after 10 s.

Calculation

To perform a DYNAVISION run, the user must select the following parameters:

- ❏ Start and end position of the run defined during the *Test Run* (= angle of rotation)
- ❏ **DYNA Time**
- ❏ Angulation step (**Angul. Step**) (°/F).

The speed of rotation and the frame rate are calculated and set automatically on the basis of these three selected parameters.

Example

Angle between the start and end positions = 125°

DYNA Time = 4.5 s

Angulation step = 4.5°/F

→

$$\text{Speed of C-arm rotation} = \frac{125^{\circ}}{4.5\ \text{s}} = 28^{\circ}/\text{s}$$

$$\text{Frame rate} = \frac{28^{\circ}/\text{s}}{4.5\ ^{\circ}/\text{f}} = 6\ \text{f/s}$$

Framerate [f/s]

The frame rates for the mask and the fill phase are automatically calculated using the **DYNA Time**, the angulation step (**Angul. Step**), and the start and end positions of the run (angle of rotation).

The frame rate for injection is fixed at 2 f/s.

Pay attention to the following parameters:

- ❏ The maximum C-arm speed
  – 40°/s with Artis dFC/dFA, Artis dBC/dBA
  – 60°/s with Artis dTC/dTA
- ❏ The maximum frame rate

Washout phase

If you continue pressing the exposure release button after the C-arm has reached the fill phase end position, the *Washout Phase* will start. In this phase, subtracted images are displayed with the washout frame rate.

Phase Time [s]

The phase times for mask and fill phases are automatically calculated using the **DYNA Time**, the angulation step (**Angul. Step**), and the start and end positions of the run (angle of rotation).

Washout

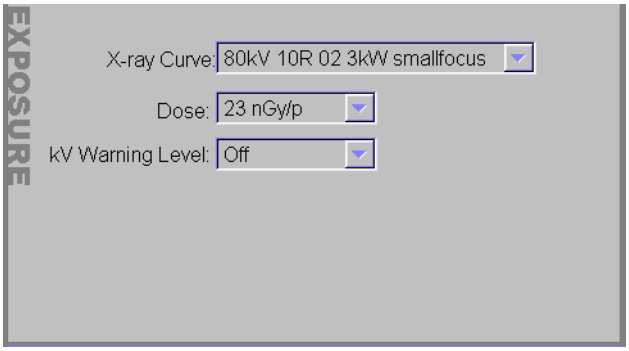
Max. scene time for the washout phase in seconds.

The scene is terminated either when the footswitch or handswitch is released or, at the latest, when the phase time for the washout phase has elapsed.

Parameters for fluoroscopy/roadmap

Radiation parameters

The **EXPOSURE** area displays the settings for radiation generation.



Exposure parameters on the **Service** subtask card (example)

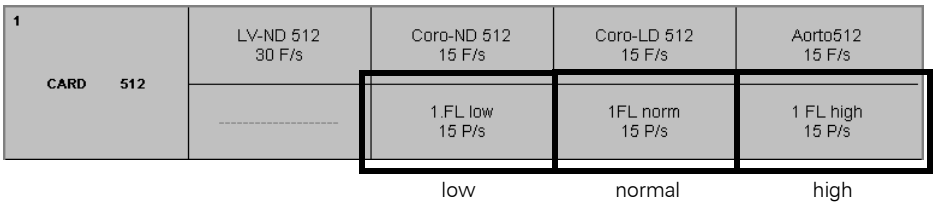
X-ray Curve Characteristic curve for automatic exposure control

100 kV 10R AF 2 kW is a curve for which a fairly high voltage is set even for a small object thickness. Therefore, this curve is particularly suitable for dose-saving operation (EP lab and pediatric examinations[1]).

High-contrast fluoroscopy With a characteristic curve with 20 R, the skin dose is not limited until 20 R/min. (This may or may not be attained, depending on the object thickness.)

Dose Fluoroscopy dose per pulse

This setting varies for the three fluoroscopy/roadmap programs: low, normal, and high.



Fluoroscopy programs

kV Warning Level Generate a warning when a specified kV value is reached.

[1] according to the German X-Radiation Regulation RöV

Image parameters for fluoroscopy/roadmap

In the **IMAGE** area, you can define default settings for image processing and image display for fluoroscopy/roadmap.

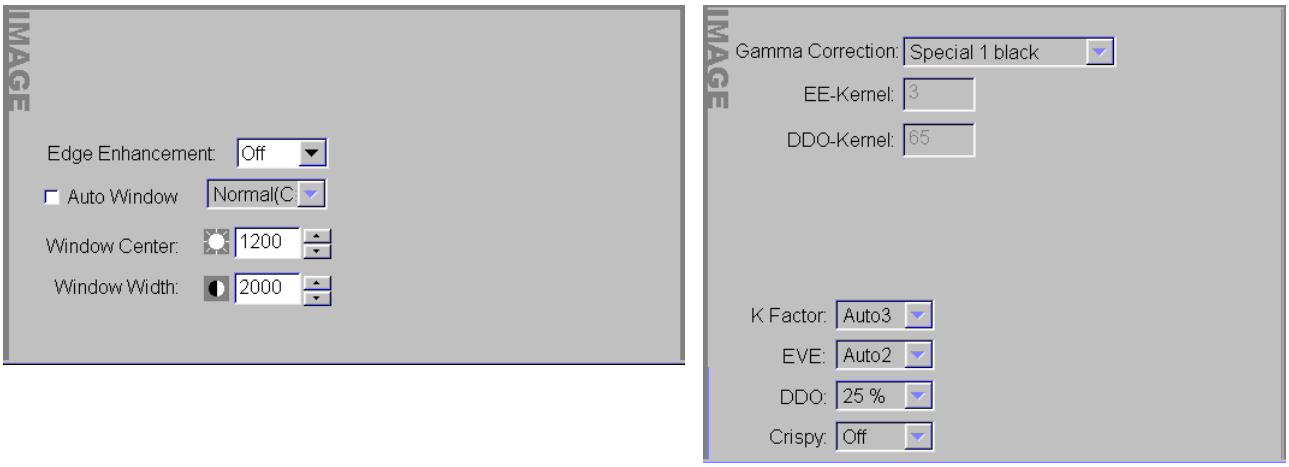


Image parameters for fluoroscopy (example)

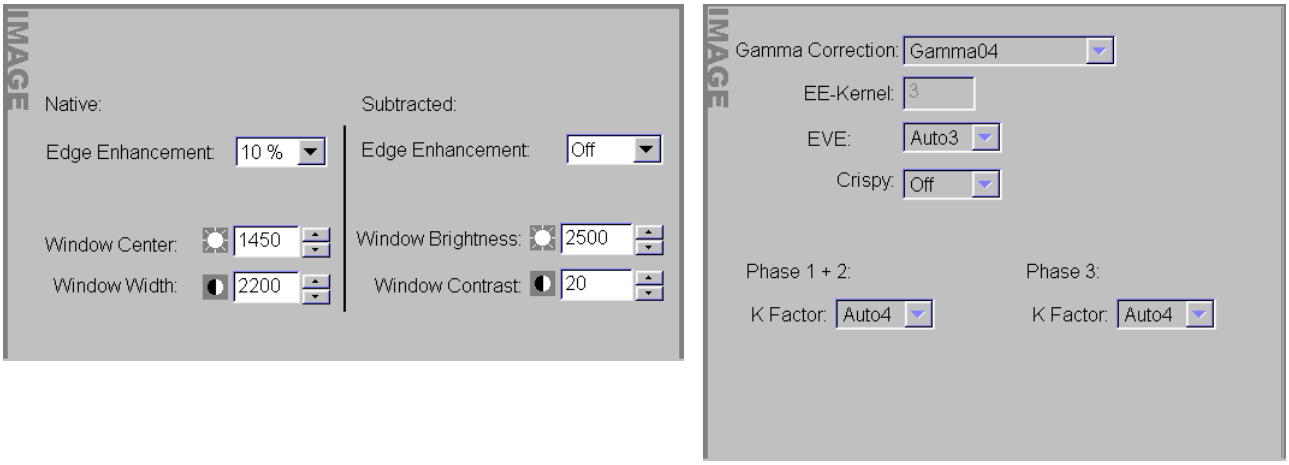


Image parameters for roadmap (example)

User parameters

Native / Subtracted Parameters for non-subtracted and subtracted fluoroscopy/roadmap

Edge Enhancement Set edge enhancement

Edge enhancement results in a clearer display of contrast differences (vessel edges). However, this also causes more noise as image noise is also displayed more clearly due to the edge enhancement.

Therefore, the filter value depends on the k factor used, but also on the preferred image impression of the examiner. As a rule, the higher the k factor, the higher the filter value can be; the lower the k factor, the lower the filter value must be.

Auto Window Set automatic windowing

Automatic windowing occurs on the basis of a histogram analysis. This allows contrast enhancement for images with more homogeneous content.

Auto Window functions well as long as the image is not collimated and does not have any extremely bright spots (air).

The maximum contrast enhancement can be configured by Siemens Service.

Auto Window is only possible for non-subtracted images.

	Window Center **Window Brightness**	Pre-setting for window center (non-subtracted) Pre-setting for brightness (subtracted)
	Window Width **Window Contrast**	Pre-setting for window width (non-subtracted) Pre-setting for contrast (subtracted)

Service parameters

Gamma Correction Display of the brightness curve correction for fluoroscopy

EE-Kernel Kernel for edge enhancement algorithm

DDO-Kernel Kernel for DDO algorithm

K Factor Averaging over time, or motion detector (**Auto1** ... **Auto4**)

⇨ "K Factor and motion detector" on page 38

EVE **E**xtended **V**essel **E**nhancement

Algorithm which emphasizes vessel edges. It works on a static image after changes of **K Factor**.

DDO **D**igital **D**ensity **O**ptimization

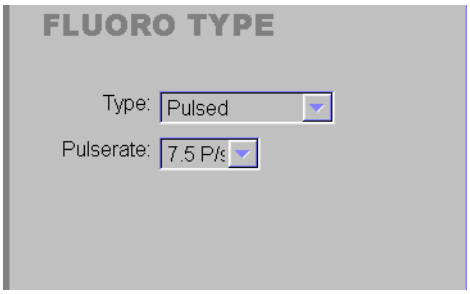
⇨ "Digital density optimization (DDO)" on page 39

Crispy Special preprocessing algorithm

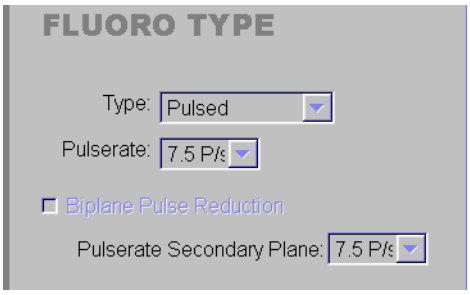
Phase 1+2 / Phase 3 Values for roadmap phases

Pulse rates

In the **FLUORO TYPE** area, you can define the settings for pulse rates for fluoroscopy/roadmap.



Frame rates single plane



Frame rates biplane

Type Selection of fluoroscopy type, e.g. **Pulsed**

ECG means that there is one fluoroscopy pulse per heartbeat, that is, fluoroscopy is always released in the same phase. (The phase can be configured by Siemens Service.) This permits dose reduction for lower pulse rates.

Pulserate Fluoroscopy pulses per second (frames per second)

Biplane Pulse Reduction Activation of the reduced frame rate in one plane for dose reduction (Artis dBC/dBA only)

Pulserate Secondary Plane

Reduced pulse rate in the second plane (frames per second)

If this parameter is activated in a biplane system, you can use a reduced frame rate in one plane and the full frame rate in the second plane. You can set the reduced frame rate separately.

The plane, primary or secondary, is selected using the footswitch fluoro pedal. The plane that was used last is regarded as the primary plane with full frame rate.

A reduced pulse rate in the secondary plane provides biplane fluoro information without doubling the dose on the patient and personnel.

Possible pulse rates

Depending on the pulse rate selected in the primary plane, only certain pulse rates may be selected in the secondary plane.

The following combinations are possible:

Primary plane [P/s]	**Secondary plane [P/s]**
0.5	0.5
1	1 / 0.5
2	2 / 1 / 0.5
4	4 / 2 / 1 / 0.5
7.5	7.5 / 4 / 2 / 1 / 0.5
15	15 / 7.5 / 4 / 2 / 1 / 0.5
30	30 / 15 / 7.5 / 4 / 2 / 1 / 0.5
60	60 / 30 / 15 / 7.5 / 4 / 2 / 1 / 0.5

General parameters

K Factor and motion detector

K Factor Averaging over time, or motion detector (**Auto1** ... **Auto4**)

Reduction of image noise by weighted averaging by the factor $\sqrt{2k-1}$. However, noise reduction may result in reduced contrast and "ghost images" of fast moving objects.

The k factor influences the noise impression of the image. A high k factor means less, and a low k factor more image noise. If high k factors are used, lag effects appear in the image.

The k factors in an AXIOM Artis system are working as follows:

- ❏ If there is a fixed k-factor larger than 1.6 *and* motion of the stand/table is detected the k-factor goes back to 1.6
- ❏ The same with fixed less than 1.6: no change in k-factor
- ❏ If **Auto...** is set, the motion detector itself detects the motion and goes back to the defined value. These defined values are configured in the system by Siemens.

Motion detector If the motion detector (**Auto1** ... **Auto4**) is used, averaging varies depending on the areas where motion occurs.

The motion detector detects bolus or catheter motion.

- ❏ In image areas with no motion (no difference to the previous image), a higher k factor is used per pixel.
- ❏ In image areas in which motion is detected (difference compared to the previous image), the k factor is automatically reduced.

This improves the image quality also for images with motion.

The following table shows which parameters are used by an **Auto** algorithm:

Setting	k-min.	k-max.	Usage
Auto1	1.25	2.0	"Cardiac speed", less integration, more noise but almost no lag.
Auto2	1.25	2.0	"Cardiac standard", good relationship between noise and lag for cardiac examinations
Auto3	1.38	2.5	"Angio" standard.
Auto4	1.88	3.0	"Roadmap" setup, very high integration but also high lag, almost no noise.

Digital density optimization (DDO)

DDO (harmonization) reduces the dynamic range of an image (bright areas will be less bright, dark areas will be less dark). By reducing the dynamic range, it is possible to increase the contrast without clipping bright or dark areas. This allows you to increase the contrast of details without saturation of the image in bright or dark areas.

For quantification, please note:
If the vessels are wide, DDO can reduce the accuracy while determining the density values, for example:

❏ 5 mm vessel, 17 cm image format, 80% DDO → Density value error: -17%

❏ 2 mm vessel, 17 cm image format, 80% DDO → Density value error: -3%

With more than 30% DDO, densitometric measurement is *no more reliable*.

Too much DDO/harmonization can change image display in such a way that a diagnosis is no longer possible.

◆ Check the image impression after using DDO/harmonization.

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Quantitative analysis methods

The **Quant** task card offers the following analysis methods:

❏ Particularly for analyzing *stenoses*

QVA With **QVA** (**Q**uantitative **V**ascular **A**nalysis) you can determine the dimensions of vessel sections.

QCA With **QCA** (**Q**uantitative **C**oronary **A**nalysis) you can determine the dimensions of the coronary arteries.

⇨ Chapter **Quantitative Vascular Analysis (QCA, QVA)**
The difference between QVA and QCA is mainly related to the size of the arteries measured:
– The **QVA** algorithm is validated for vessels from 3 mm to 42 mm.
– The **QCA** algorithm is validated for vessels from 1.5 mm to 7 mm.

❏ For determining the volume of cardiac ventricles

LVA With **LVA** (**L**eft **V**entricle **A**nalysis) you can determine the ejection fraction and the wall motion of the *left* cardiac ventricle.

LVA (biplane) With **LVA biplane** you can perform a more precise analysis using images of both acquisition planes.

⇨ Chapter **Quantitative Ventricular Analysis (LVA)**

You can display the results on the screen like image data, film/print and send them or export them as a spreadsheet file.

Important notes

Specialized knowledge

The analysis software may only be used by a specialist for radiology, a cardiologist or under his supervision. The analysis data must be interpreted by a trained specialist if you want to use them for a diagnosis or as a basis for deciding on a treatment strategy.

State of the art

The clinical analysis software has been carefully tested before delivery. The software has been developed according to mathematical models which are discussed in specialist literature and used in medical research. Siemens accepts no responsibility for any inaccuracies of whatever nature resulting from the use of this software.

- ◆ Please read the relevant bibliographic information.

Calibration

If the guidelines for calibration are not followed, the results of absolute measurements can be inaccurate or unreliable.

Calibration accuracy has a direct influence on the accuracy of the calculated values such as arterial diameters or ejection fractions. Generally the reason for large deviations from expected values is incorrect calibration.

Regular reference measurements are necessary to ensure calibration accuracy.

⇨ Chapter **Calibration**

Rectangular pixels

The algorithms have been adapted in order to process images with *square* pixels, such as are found in Siemens images. If you use images, e.g. from CDs, with other pixel shapes (e.g. rectangular), then the results might be unreliable.

Unfiltered images

Use *only* unfiltered images to ensure that contour detection leads to accurate results.

Unflipped images

Use *only* unflipped images or flip them back.

Quantitative analysis is not possible with flipped images.

Matrix size

You can improve measurement accuracy by using a larger image matrix.

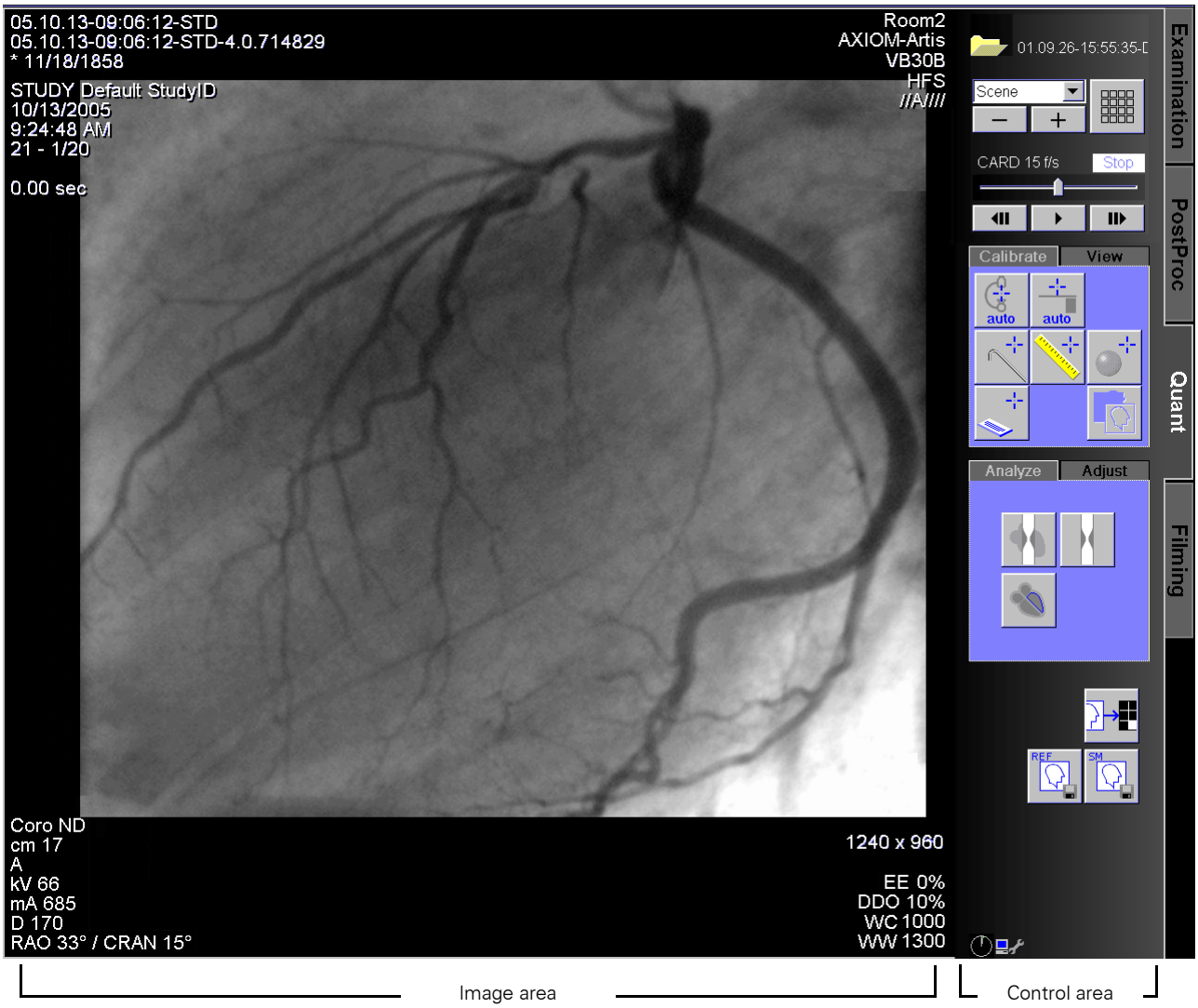
The Quant task card

In addition to the **PostProc** task card, the **Quant** task card will also appear on your system if quantification is licensed on it. It is structured just like the **PostProc** task card, but offers other functions.

At the system console in the control room

Single plane system

In case of a single plane system, the control area is located on the right.



Quant task card (example)

Calling up the Quant task card

◆ Click on the tab of the **Quant** task card.

Or

◆ Press **F10**.

The **Quant** task card is placed in the foreground.

Biplane system

In the case of scenes of systems with two acquisition planes, you will find the control area:

❑ on the left or right for plane A (floor stand)

❑ on the right for plane B (top stand)

Quant task card biplane (example)

Activating a plane

In the case of scenes of biplane systems, quantification can be performed separately in each plane.

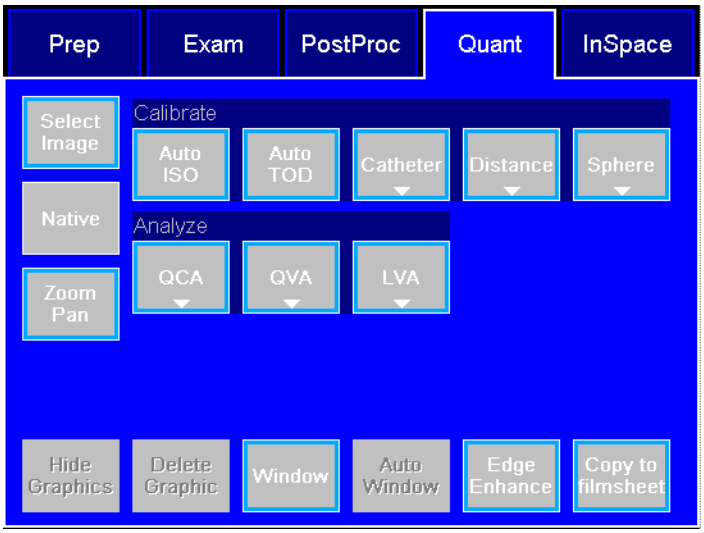
◆ To do so, move the mouse pointer from one monitor to the other.

◆ Click on the image on the monitor of the required plane.

Now you can select the icons of this plane.

At the touchscreen control in the examination room

On the **Quant** task card you will find a few general functions and functions for quantitative analysis.



Quantification should only be performed either from the examination room *or* from the control room. Do not change the place of operation during quantification!

General postprocessing functions

Selecting patients and scenes/images

As in the case of the **PostProc** task card, you will find the patient data as well as the operating elements for selecting the scene and the images in the upper part of the control area.

⇨ Part **Image Viewing and Image Processing**, Chapter **General**, "Loading a scene/image"

A scene will always be loaded simultaneously (i.e.only once) in the **PostProc** *task card and in the* **Quant** *task card.*

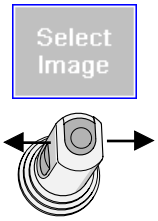
You can therefore toggle between **Quant** *and* **PostProc** *and will always have the same scene!*

Graphics drawn in the **PostProc** *task card will not be shown in the* **Quant** *task card.*

Switching over the IS joystick function

Scrolling

You can switch between the currently selected function and scene review at any time.



◆ Activate **Select Image** on the **Quant** task card.

– The selection field appears selected.

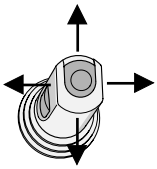
◆ Tilt the IS joystick.
– The previous/next image is displayed.

Graphic processing

If you have selected the correct image and want to edit graphic elements, switch over to graphic processing.

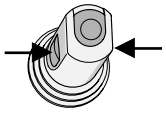
- Activate **Mark / Modify** on the **Quant** task card, if necessary.

  – The selection field appears selected.



- Now you can draw graphic elements with the IS joystick, select them, move them, etc.

⇨ Also see Part **Image Viewing and Image Processing**, Chapter **Image Post-processing**, "General information about text and graphics"



You can move the elements by keeping the function button on the side of the joystick pressed (drag-and-drop).

Return with saving

If the graphic element is positioned correctly, you can save it and return to the previous function.

- Press a **selection button** ("fire button") on the top or rear of the joystick.
  – The current values are accepted.
  – The function is deselected.

Return without saving

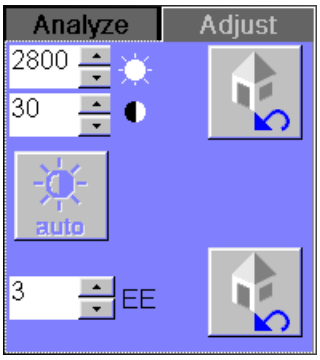
If you do not want to save the changes, deselect graphic processing.

- Deactivate **Mark / Modify**. .
  – The function is deselected.

After deactivation of **Mark / Modify**, the system will take several seconds to be ready again.

Defining window and filter values

On the **Adjust** subtask card, you can set the window values and use edge enhancement filters.



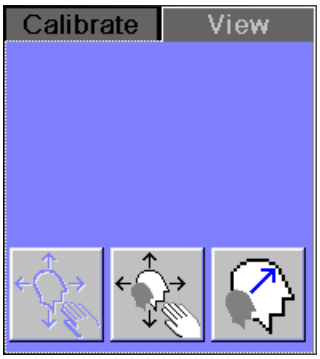
⇨ Part **Image Viewing and Image Processing**, Chapter **Image Postprocessing**, "Defining window and filter values"

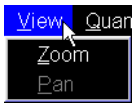
On the **Quant** task card, you *cannot* window using the middle mouse button or using the keys on the symbol keypad of the keyboard.

◆ Use controls on the **Adjust** subtask card instead .

Zooming/panning

On the **View** subtask card or in the **View** menu you can switch on zooming and pan the image.





⇨ Also see Part **Image Viewing and Image Processing**, Chapter **Managing and Viewing Scenes/Images**, "Magnifying the scene/image, zooming/panning"

Switching on zoom

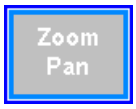
At the system console

- Click on the required icon.

Or

- Select **View > Zoom** from the main menu.
  – The next time you select the menu, this item will be marked with a check-mark.

At the touchscreen control



- Activate **Zoom Pan** on the **Quant** task card.
  – The selection field appears selected.

The image is enlarged by a factor of two.

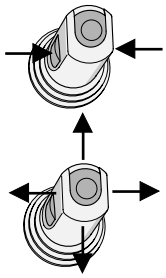
Panning

At the system console

Panning is automatically activated if the image is zoomed.

- Move the mouse pointer into the image.
  – The mouse pointer changes shape.
- Click and drag in the image area.

At the touchscreen control



- Press one or both **function buttons** on the side of the joystick and keep the button(s) pressed.
- Tilt the IS joystick.

The image is panned simultaneously.

No panning

At the system console

If you want to switch off panning, e.g. for graphic processing, proceed as follows:

- Click on this icon.
  – The icon appears no longer selected.

Or

- Select **View > Pan** from the main menu.
  – The next time you select the menu, this item will not be marked with a checkmark.

At the touchscreen control

- Deactivate **Zoom Pan**.
  – The function is deselected.

After deactivation of **Zoom Pan**, the system will take several seconds to be ready again.

Measuring distances and angles

You will find the tools for simple evaluation on the **Tools** subtask card on the **Quant** task card.

Calibration

Before you can measure distances you must calibrate the image.

⇨ Chapter **Calibration**

Distances

⇨ Part **Image Viewing and Image Processing**, Chapter **Image Postprocessing**, "Drawing and measuring distances"

Angles

⇨ Part **Image Viewing and Image Processing**, Chapter **Image Postprocessing**, "Drawing and measuring angles"

Hiding/displaying measurements

Measurements off

At the system console

◆ Click this icon on the **Tools** subtask card.

At the touchscreen control

◆ Activate **Hide Graphics** on the **Quant** task card.

The graphics in the image are hidden.

Measurements on

At the system console

◆ Click the active icon on the **Tools** subtask card.

At the touchscreen control

◆ Deactivate **Hide Graphics** on the **Quant** task card.

The graphics in the image are displayed.

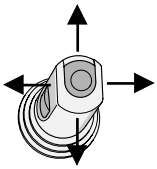
Deleting graphics

At the system console

◆ Click on the graphic element you want to delete.

◆ Press the **Del** key on the keyboard.

At the touchscreen control



◆ Position the mouse pointer on the end point of a line using the IS joystick.
– The cross hair changes.

◆ Activate **Delete Graphic** on the **Quant** task card.

The selected graphic element is deleted.

Functions during an analysis

Undoing changes

Last change **At the system console (only)**

◆ Click on this icon.
– The last change is undone.

All changes **At the system console (only)**

◆ Click on this icon.
– All changes since the last save operation are undone.

Hiding/displaying analysis graphics

Graphics off **At the system console**

◆ Click this icon in the lower part of the control area.

At the touchscreen control

◆ Activate **Hide Graphics** on the **Quant** task card.

The graphics in the image are hidden.

Graphics on **At the system console**

◆ Click the active icon in the lower part of the control area.

At the touchscreen control

◆ Deactivate **Hide Graphics** on the **Quant** task card.

The graphics in the image are displayed.

Calling up the last measurement

You can call up the last processed image with the graphic elements as long as you do not re-start the imaging system.

At the system console (only)

- Click this icon on the **Tools** subtask card.

Documenting images and reports

If an image in 1024^2, into which a contour is drawn, is recalculated to an image matrix of 512^2, the contour may be lost.
Consequently, an image that is sent/exported in 512^2 may *not* include the contour.

- Images with contours should only be sent /exported in the 1024^2 image matrix.
- You can create a **Store Monitor** image for this purpose, if required.

Storing the current image (Store Monitor)

At the system console

- Click on this icon (of the required plane).

At the touchscreen control

- Activate the required plane.

- Activate **Store Monitor** (to the left of the card stack).

The current image is stored as "Store Monitor" on series/image level.

Only the image of the active plane is stored.

Generating and storing a report

After completing an analysis (QCA/QVA/LVA) you can store a report and film, print or send it with the images you analyzed.

Normal report

At the system console

- Click on this icon.

At the touchscreen control

- Activate **Display Report** on the **Quant** task card, **LVA** or **Stenosis** subtask card.

  – A one-page report is generated.

Detailed report **At the system console (only)**

- Click on this icon.
  – A report consisting of several pages is generated.

Scrolling **At the system console**

- Click on one of these icons.
  – The previous/next page of the report is displayed.

Storing a report **At the system console**

- Click on this icon.

At the touchscreen control

- Activate **Store Report** on the **Quant** task card.

The report is stored together with the analyzed image.

The **Quant Report** *is stored as a new series.*

You can see it in the **Patient Browser** *or by scrolling with* **Scene +/-**.

You can film, print, or send a report in the same way as a normal scene.

Results of an analysis on the **Quant** quant task card are only transferred to the film sheet if the **Report** is stored.

Default settings

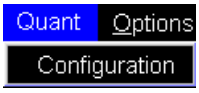
In **Quant Configuration**, you can check and configure measurement and output features.

See also
- ⇨ Chapter **Calibration**, "Configuring the calibration"
- ⇨ Chapter **Quantitative Vascular Analysis (QCA, QVA)**, "Configuring QCA/ QVA"
- ⇨ Chapter **Quantitative Ventricular Analysis (LVA)**, "Configuring LVA"

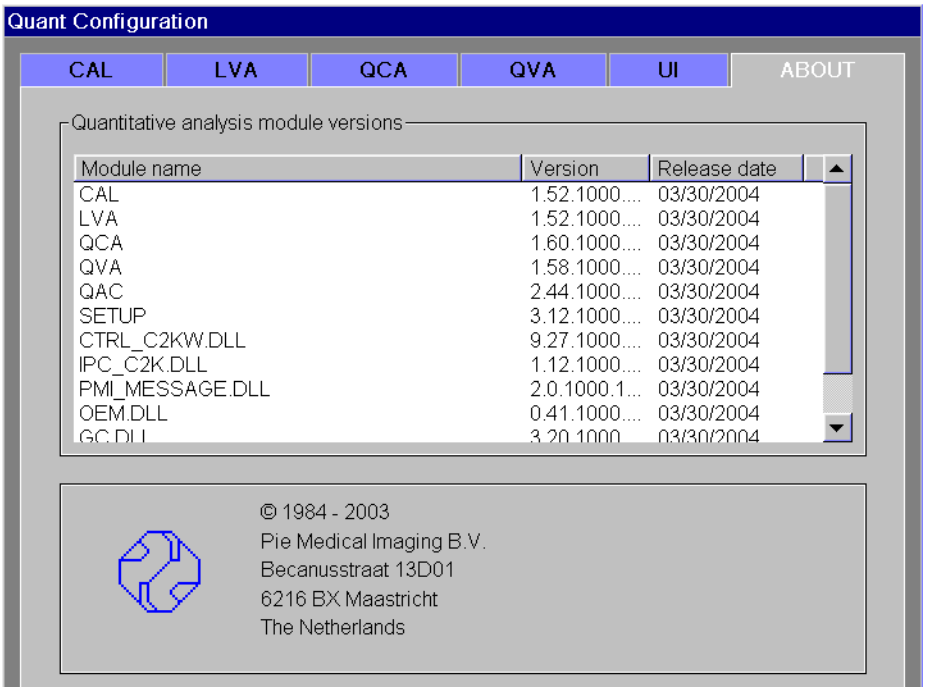
Checking the installed options

Depending on the options installed, certain analysis methods will be available or not. This is how you can find out which program parts are licensed:

At the system console (only)



- ◆ Select **Quant > Configuration** from the menu.
  – The **Quant Configuration** window is displayed.
- ◆ Click the **ABOUT** subtask card into the foreground.
  – The installed modules are displayed.



Closing default settings

Resetting values to default settings at installation

◆ Click on **Default**.
– All settings are reset to the Siemens default values.

Accepting changes

◆ Click on **OK**.
– The settings are confirmed.
– The window is closed.

Rejecting changes

◆ Click on **Cancel**.
– The window is closed without changing the previous settings.

Calibration

Introduction

Before you can perform measurements (distance, angle, quantification), the scene must be calibrated.

For *biplane* analysis, you must perform calibration for each projection direction (RAO and LAO).

Warning

Incorrect calibration

Inaccurate results possible

The examiner is responsible for applying the correct calibration method.

◆ Perform calibration carefully.

Calibration methods

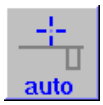
Depending on the examination to be performed, you can use different calibration methods:

⇨ Part **Image Viewing and Image Processing**, Chapter **Image Postprocessing**, "Which calibration method for which angulation angle?"

automatic

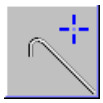
❑ **Auto ISO**
Calibration is performed fully automatically for an organ positioned in the isocenter (= rotation center) on the basis of the known exposure geometry. Siemens Service performs an exact calibration for this exposure geometry during installation of the system.
– Advantage: You can work quickly.
– Disadvantage: This calibration method should be used only if the organ to be examined was in the isocenter during the acquisition. Otherwise there can be significant measuring uncertainties.

semi-automatic



❏ **TOD** (table-object distance)
The calibration is automatically computed based on the known exposure geometry. You only need to enter the TOD.
Siemens Service performs a precise calibration when the system is installed.
– Advantages: The TOD is same in the supine position for most patients. You can work quickly.
– Disadvantage: The error in the TOD value limits the measurement accuracy.

manual



❏ **Catheter**
Calibration is based on the known diameter of the catheter.
– Advantages: The catheter is, so to speak, "in situ". There is only slight uncertainty due to geometrical distortion. Another advantage is that you know the exact catheter diameter (usually in French units).
– Disadvantage: The diameter of the catheter is relatively small. Therefore, the known diameter corresponds to relatively few pixels in the image. This places a limit on the measurement accuracy.

❏ **Distance**
Calibration is based on the known distance between two points of an object placed in the beam path.
– Advantage: The distance can be measured accurately.
– Disadvantage: Measuring errors can occur due to geometrical distortion.

❏ **Sphere**
Calibration is based on a sphere with known diameter. The sphere is placed in the beam path after the examination. The same distances must be observed as for the scene to be analyzed.
– Advantages: The diameter of the sphere can be determined very accurately and does not depend on the beam direction (due to spherical shape).
– Disadvantages: A separate acquisition must be performed with the sphere. If placed inaccurately, measurement uncertainties will occur depending on patient size.

❏ **Calibration factor** (**manual calibration**)
Enter the calibration factor based on your experience with other calibration methods.
– Advantage: You can work quickly.
– Disadvantage: If the measurement conditions are not absolutely identical, significant measuring uncertainties can occur.

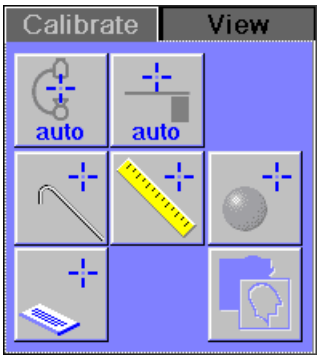
Performing a calibration

Pay attention to the messages at the bottom of the image.
They include notes for further operational steps.

Calling up calibration

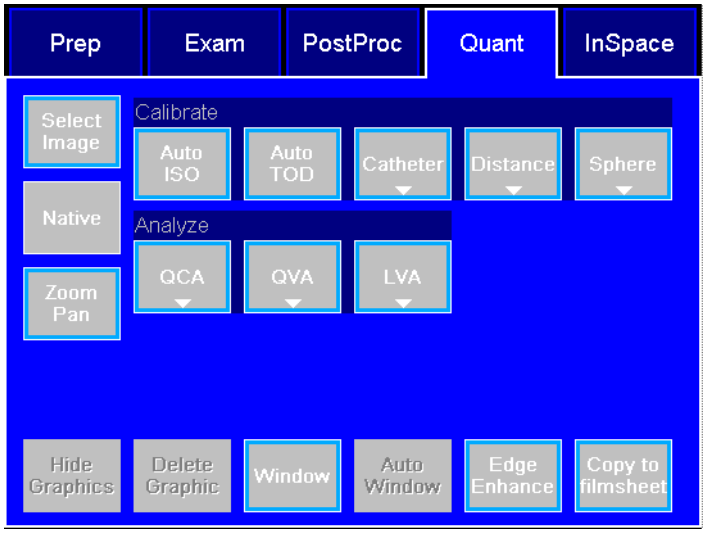
You will find the tools for calibrating the images on the **Calibrate** subtask card on the **Quant** task card and in the **Options** menu.

At the system console



At the touchscreen control

- Activate the **Quant** task card, if necessary.



General functions

Undoing the last calibration step

If, for example, you have made an error during the last calibration but would still like to save the previous values (average), you can undo the last step:

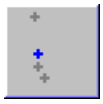
At the system console (only)

- Click on this icon in the corresponding calibration window.
  – The last calibration step is undone.

Confirming calibration / calculating the average

To increase the accuracy of the measurement, you can perform several measurements and calculate their average.

At the system console (only)



- Click on this icon after each measurement in the corresponding calibration window.
  – The measurement is recorded and a new average value is calculated with the previous value(s).
  – The new calibration is applied.
  – The new value is displayed immediately.

Clearing the entire calibration

If you wish to clear the entire calibration since the last scene / image call-up or since selecting calibration:

At the system console (only)

- Click on this icon in the corresponding calibration window.
  – All changes since the last save operation are undone.

Recalling the last calibration

You can call up the last processed calibration image as long as you do not restart the imaging system or reregister a patient.

> You can only recall the last *completed manual calibration*.
> Recalling the last calibration does not work with the automatic calibration methods **Auto ISO** or **Auto TOD**.

At the system console (only)

You have performed a *manual calibration* in a frame of the scene, marked a contour and clicked **OK**.

May be, you have performed another calibration (with another frame of the scene) but you have rejected it via **Cancel**.

- Click on this icon on the **Calibrate** subtask card.
  - The last valid calibration (and if necessary the corresponding frame of the scene) is recalled.

Automatic isocenter calibration

If the organ to be examined was in the isocenter during acquisition, you can use automatic calibration.

Automatic start

The system is ready for calibration as soon as you select **Quant**. A message indicating this is displayed in the lower part of the image.

Isocenter calibration is automatically preselected for >50° angulations by the system.

Starting manually

If a different calibration was performed, you can restore the automatic isocenter calibration.

At the system console

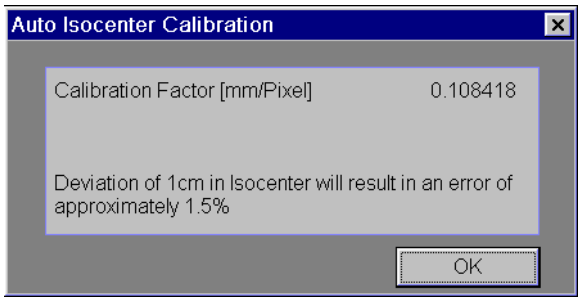
- Click on this icon.

At the touchscreen control

- Activate **Auto ISO**.

Confirming

The system calculates the calibration factor on the basis of the image geometry.
– The calculated calibration factor is displayed.


Auto Isocenter Calibration
Calibration Factor [mm/Pixel] 0.108418
Deviation of 1cm in Isocenter will result in an error of approximately 1.5%
OK

◆ Confirm by clicking on **OK**.
– Automatic calibration is performed immediately and displayed.

Calibration using the table-object distance (TOD)

If the organ to be examined is at a defined distance from the tabletop, you can use TOD calibration.

AXIOM Artis system	Type of examination	TOD default value
Artis dFC/dFA, Artis dBC/dBA, Artis dTC/dTA	Cardiac	20 cm
	General vascular	15 cm
Artis dMP	Cardiac	17 cm
	General vascular	12 cm

The default value for TOD can be changed by Siemens Service.

Automatic start

TOD calibration is automatically preselected by the system for angulations between 15° and 50°. You are prompted to mark the measurement point in the image. Only then can you adjust the TOD.
– In that case, a message is displayed.

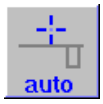
◆ Click on the point in the image where you want to perform a measurement.

TOD calibration is not suitable for angulations >50°!

Starting manually

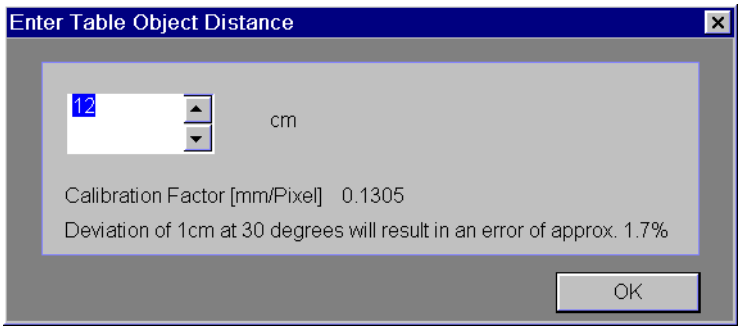
You can also select TOD calibration manually.

At the system console



◆ Click on this icon.

The system calculates the calibration factor on the basis of the image geometry.
– The previous calibration factor - if there is one - is displayed.


Enter Table Object Distance
12
cm
Calibration Factor [mm/Pixel] 0.1305
Deviation of 1cm at 30 degrees will result in an error of approx. 1.7%
OK

Entering TOD

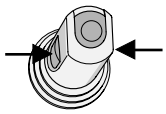
◆ Enter the table-object distance in the field or click on the arrows to change the value.
– The calibration factor and the error are shown in the box.

◆ Confirm by clicking on **OK**.

At the touchscreen control

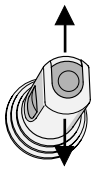
◆ Activate **Auto TOD**.

For angulations >15°, you are prompted to mark the measurement point in the image. Only then can you adjust the TOD.

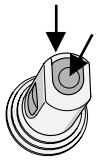


◆ In that case, click on the point in the image where you want to perform a measurement.
– A TOD display appears on the monitor in the examination room.

Entering TOD



◆ Tilt the IS joystick.
– *Up*: *increase* TOD
– *Down*: *reduce* TOD



◆ Press a **selection button** ("fire button") on the top or rear of the joystick.
– The TOD is accepted.
– The function is deselected.
– The calibration factor is displayed.

Catheter calibration

In order to mark the known diameter, you must trace the *outer* contours of the catheter.

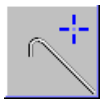
Some catheter brands cannot be used for calibration as *their outer dimensions are not accurate enough*.
To improve the calibration accuracy, we recommend *measuring* the actual catheter thickness before calibrating.
The *smaller the calibration object, the greater the calibration error*.

You must also take a possible error into account due to the difference in the degree of magnification of the catheter and the vessel to be analyzed, if the catheter and the vessel are located *at different tissue depths,* that is, at different distances from the image intensifier or flat detector. The error is estimated to be 1 to 1.5 % for each cm of difference in depth.

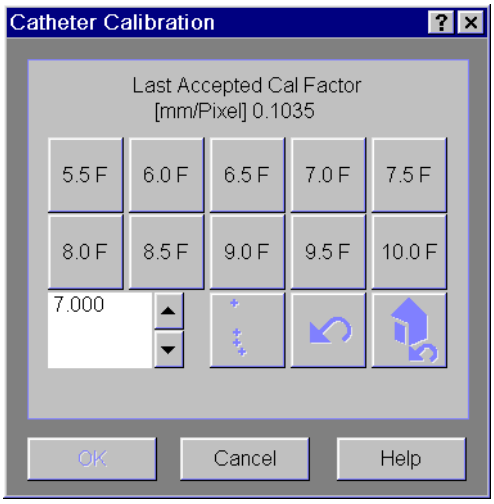
Catheter calibration is *not recommended for LVA* because the calibration object is much smaller than the measured object, and even slight deviations in calibration can result in significant errors in volume calculation.
For QVA, catheter calibration should be used *with I.I./FD zoom stages only (not in overview format)*.

The catheter calibration software is validated for a catheter size of 7 French. Using catheter calibration with catheter sizes of 4 French or smaller is not allowed because accuracy would not be sufficient.

Starting **At the system console**



- Click on this icon.
  – The previous calibration factor - if there is one - is displayed.



You can configure the catheter sizes which are displayed.

➪ "Configuring the calibration" on page 40

Drawing in the center line of the catheter

Mark the approximate center line in the section of the catheter you want to use for calibration. This part of the catheter should be straight.

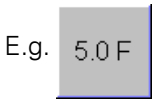
You can configure whether only straight or also curved catheters are permitted.

➪ "Configuring the calibration" on page 40

- Mark the starting position of the center line with a single click.
- Now move the mouse pointer to the point where you want to end the center line and mark this point with a mouse click.
  – The contour detection algorithm automatically detects the edges of the catheter.

Entering the catheter size

Now enter the actual size of the catheter used for calibration (in French units).



◆ Select the approximate French value by clicking on a button.

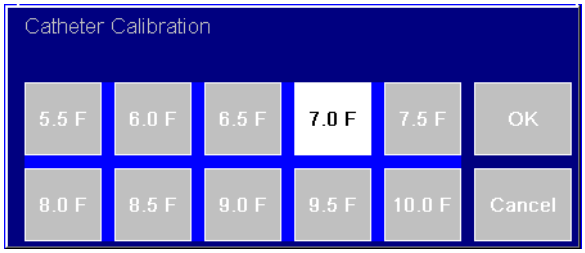
◆ Then click on the arrows to correct the value until you reach the exact value.

Or

◆ Enter the exact value in the field.

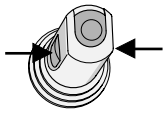
Starting **At the touchscreen control**

◆ Activate **Catheter**.



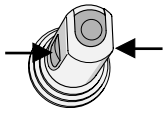
Drawing in the center line of the catheter

◆ Position the mouse pointer on the starting point of the catheter centerline with the **IS joystick**.

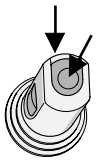


◆ Press one or both of the **function buttons** on the side.

◆ Position the mouse pointer on the end point of the catheter centerline with the **IS joystick**.



◆ Press one or both of the **function buttons** on the side.



- Press a **selection button** ("fire button") on the top or rear of the joystick.
  – The contour detection algorithm automatically detects the edges of the catheter.

Entering the catheter size

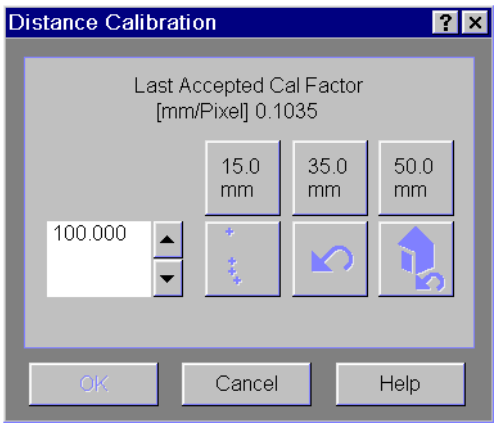
- Activate the appropriate selection field.
- Confirm with **OK**.
  – The calibration factor is displayed in the control area.

Distance calibration

The calibration object should be larger than the object to be measured.
The calibration object must also be located in the same plane as the object to be measured!

Starting **At the system console**

- Click on this icon.
  – The previous calibration factor - if there is one - is displayed.



You can configure the distances which are displayed.

⇨ "Configuring the calibration" on page 40

Drawing the distance line

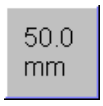
- Click on the image to mark the starting point and drag the mouse along a line to the end point.
  – As soon as you move the mouse, a line is displayed.
- Click the mouse button a second time to end the line.
  – The distance line is then drawn.

Changing the distance line

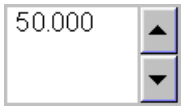
- Click on one of the two end points of the distance line, drag the line larger or smaller, and click on the new end point.
  – The distance line changes accordingly as soon as you move the mouse pointer.
- Release the mouse button.

Entering a distance

Finally, enter the actual length of the distance used for calibration.

E.g. 

- Select the approximate distance by clicking on a button.



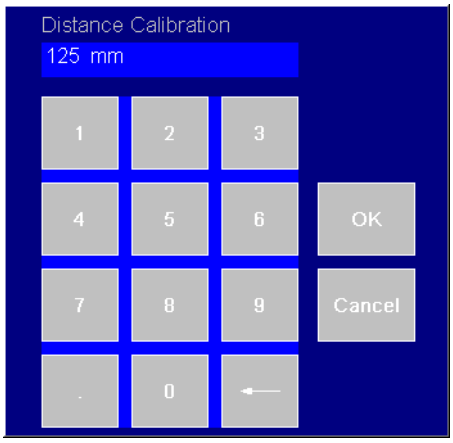
- Then click on the arrows to correct the value until you reach the exact value.

Or

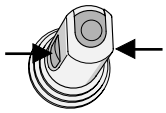
- Enter the exact value in the field.

Starting **At the touchscreen control**

◆ Activate **Distance**.

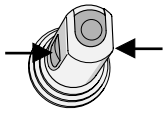


◆ Position the mouse pointer on the starting point of the distance line with the **IS joystick**.

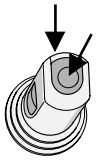


◆ Press one or both of the **function buttons** on the side.

◆ Position the mouse pointer on the end point of the distance line with the **IS joystick**.
– As soon as you tilt the joystick, a line is displayed.



◆ Press one or both of the **function buttons** on the side.



◆ Press a **selection button** ("fire button") on the top or rear of the joystick.
– The line is drawn.
– The function is deselected.

Entering a distance

◆ Enter the correct value in the numeric input field.

◆ You can correct input errors with **<-**.
– The figure last entered is deleted.

◆ Confirm with **OK**.
– The calibration factor is displayed in the control area.

Sphere calibration

The *smaller the calibration object, the greater the calibration error*.

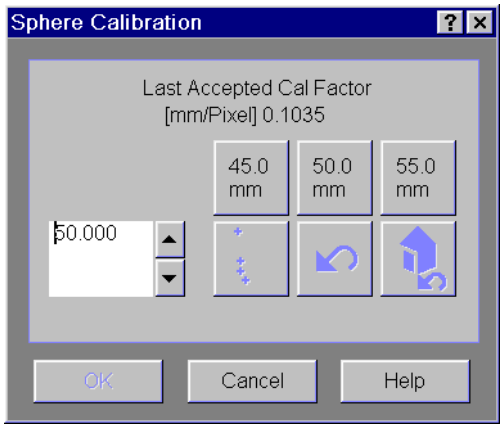
Make sure that the image with the sphere was acquired under the same conditions (zoom stage, source-l.l./FD distance and object-l.l./FD distance) like the image you want to analyze.

You can configure the sphere sizes which are displayed.

⇨ "Configuring the calibration" on page 40

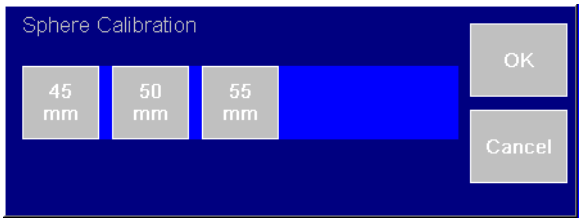
Starting **At the system console**

◆ Click on this icon.
– The previous calibration factor - if there is one - is displayed.



At the touchscreen control

◆ Activate **Sphere**.



Drawing a circle

At the system console or at the touchscreen control

For marking the sphere, you must draw a circle that corresponds to the projection of the sphere in the acquisition plane.

The circle can be marked in two ways:

❑ Center, diameter
Define the center of the sphere and determine its diameter.

❑ 3 points
Define the sphere by fixing three points along the line of circumference.

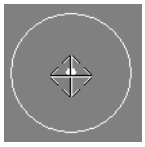
Center, diameter

◆ Click into the center of the sphere and drag the cursor to the line of circumference.

3 points

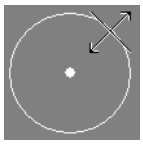
◆ Click on three points in succession on the line of circumference, with a single click at each point.

Moving the circle



- Move the mouse pointer onto the center of the circle.
  – The mouse pointer changes shape.
- Click and drag the circle to the required position.
- Release the mouse button.

Changing the size



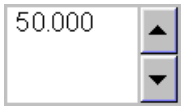
- Move the mouse pointer onto the circle line.
  – The mouse pointer changes shape.
- Click and drag the circle out larger or smaller.
  – The size of the circle changes, while the center remains fixed.
- Release the mouse button.

Diameter Finally, enter the actual diameter of the sphere used for the calibration.

At the system console

E.g.

- Select the approximate diameter by clicking on a button.



- Then click on the arrows to correct the value until you reach the exact value.

Or

- Enter the exact value in the field.

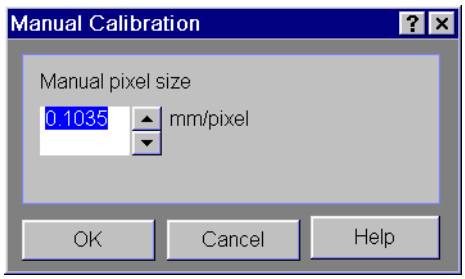
At the touchscreen control

- Activate the appropriate selection field.
- Confirm with **OK**.
  – The calibration factor is displayed in the control area.

Calibration with a calibration factor

Starting **At the system console (only)**

- Click on this icon.
  – The previous calibration factor - if there is one - is displayed.



You can configure the value range for the calibration factor.

⇨ “Configuring the calibration” on page 40

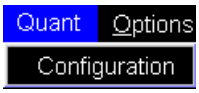
Entering the calibration factor

- Enter the exact value in the field or use the arrows.

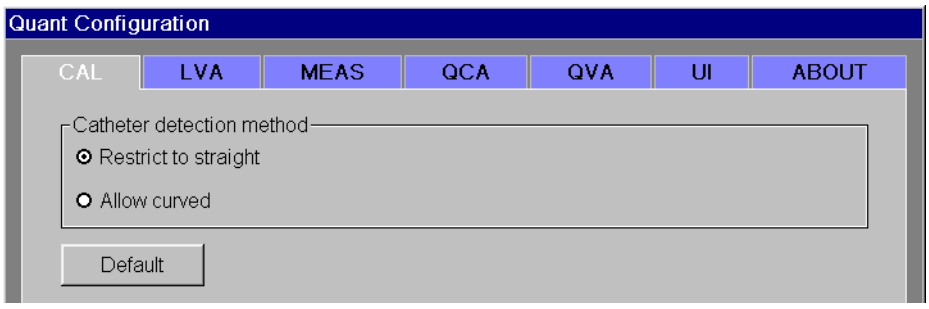
Configuring the calibration

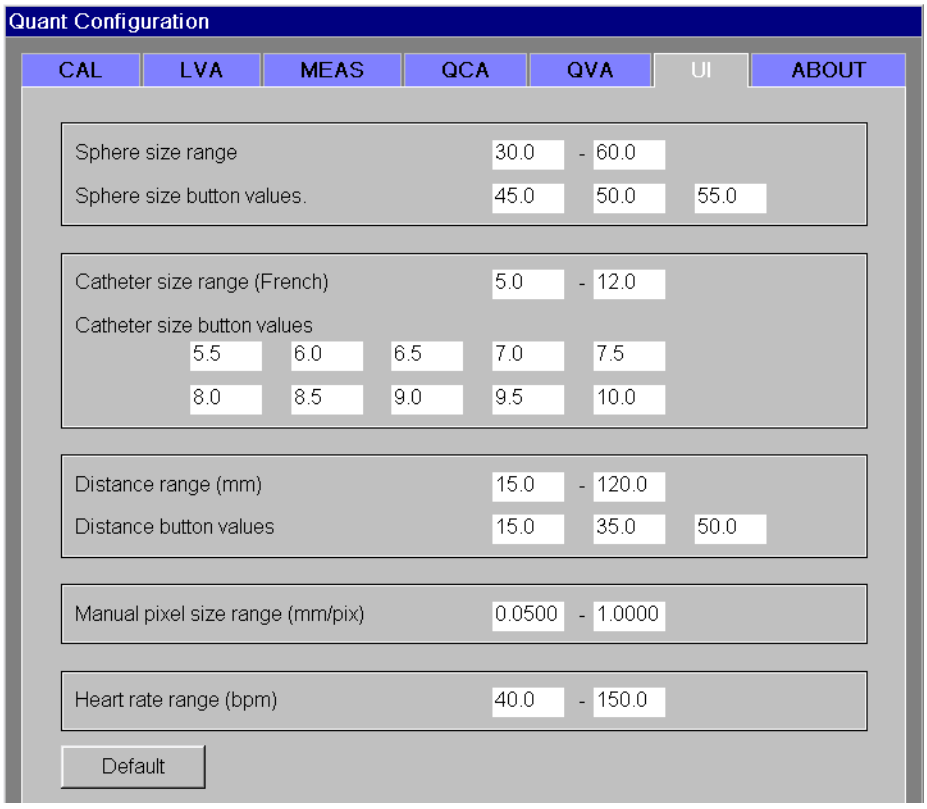
You can make a few settings to adapt calibration to your normal practice.

At the system console (only)



- Select **Quant > Configuration** from the menu.
  – The **Quant Configuration** window is displayed.
- Click the **CAL** or **UI** subtask card into the foreground.

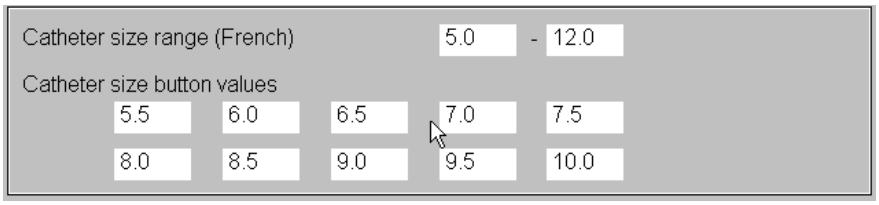




Method for catheter calibration

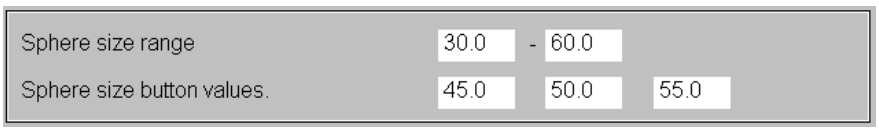
- On the **CAL** subtask card, select whether only straight or also curved catheters should be allowed.

Catheter sizes



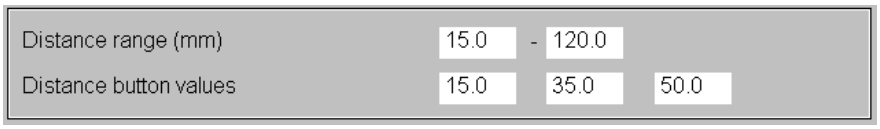
- On the **UI** subtask card enter the catheter sizes used in your practice.

Sphere sizes



- On the **UI** subtask card enter the sphere sizes used in your practice.

Distances



- On the **UI** subtask card enter the distances that could be used.

Pixel sizes

- On the **UI** subtask card enter the relevant pixel sizes for manual calibration in your practice.

Cardiac frequency

⇨ Chapter **Quantitative Ventricular Analysis (LVA)**, "Configuring LVA"

Closing the window

⇨ Chapter **General**, "Closing default settings"

Starting vascular analysis

Selecting a scene/image

- Load a suitable scene from the **Patient Browser** onto the **Quant** task card by drag-and-drop or a double click.

⇨ Part **Image Viewing and Image Processing**, Chapter **General**, "Loading a scene/image"

The selected image plays an important role in accurate and reproducible contour detection.

We recommend selecting an image *close to the diastolic phase* of the cardiac cycle. The vessel moves only minimally in this cardiac phase, so that the changes of the display size are negligible and reproducibility of the detected contour is guaranteed. Changes in contour due to the rotation of an asymmetrical artery are also insignificant in this phase. In addition, possible kinetic blurring because of the length of the X-ray pulse is minimal in the diastolic phase. This ensures improved image quality and, consequently, more accurate contour detection.

- Scroll through the scene to the required image.

⇨ Chapter **General**, "Switching over the IS joystick function" and Part **Image Viewing and Image Processing**, Chapter **Managing and Viewing Scenes/ Images**

Calibration

Before you can perform a quantitative vascular analysis, you must calibrate the image.

Make sure that the calibration object and the vessel segment have the same geometric acquisition parameters, that is,

- ❏ the same focus-to-object and object-to-I.I./FD distances
- ❏ the same I.I./FD size
- ❏ the same image matrix

Otherwise the absolute distances will be less reliable.

To calibrate the image, use an object with almost the same size as the object to be measured, e.g. an (empty) catheter for an artery segment.

For distance measurements, it is advisable to calibrate over a distance of at least 3 cm.

⇨ Chapter **Calibration**

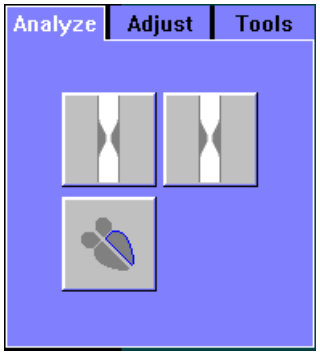
Selecting the analysis method

Depending on the installation, some analysis methods may not be available to you.

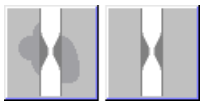
At the system console

After you have calibrated the image, select the analysis method on the **Analyze** subtask card.

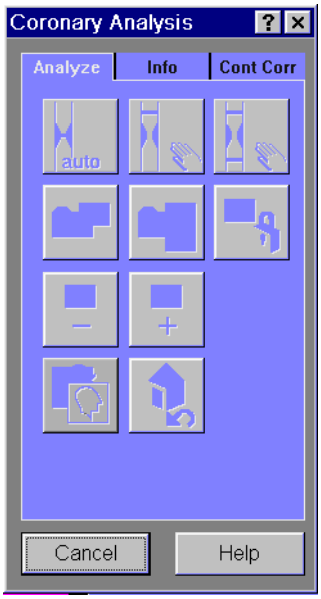
	QCA	quantitative coronary analysis for measuring stenoses in coronary arteries (1.5 mm to 7 mm)
	QVA	quantitative vascular analysis for measuring stenoses in other arteries (3 mm to 42 mm)

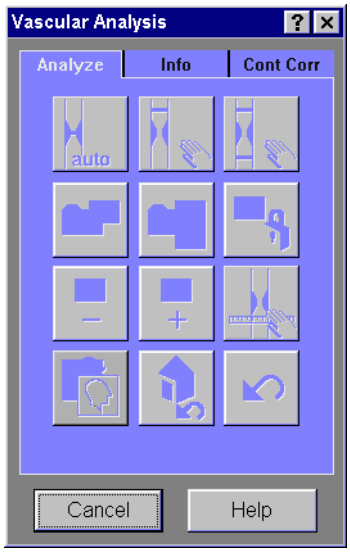


◆ Click the **Analyze** subtask card to the top, if necessary.



◆ Click on the appropriate icon (**QCA** or **QVA**) on the **Analyze** subtask card.
– The **Coronary Analysis** or **Vascular Analysis** window appears with the **Analyze, Info,** and **Cont Corr** subtask cards.



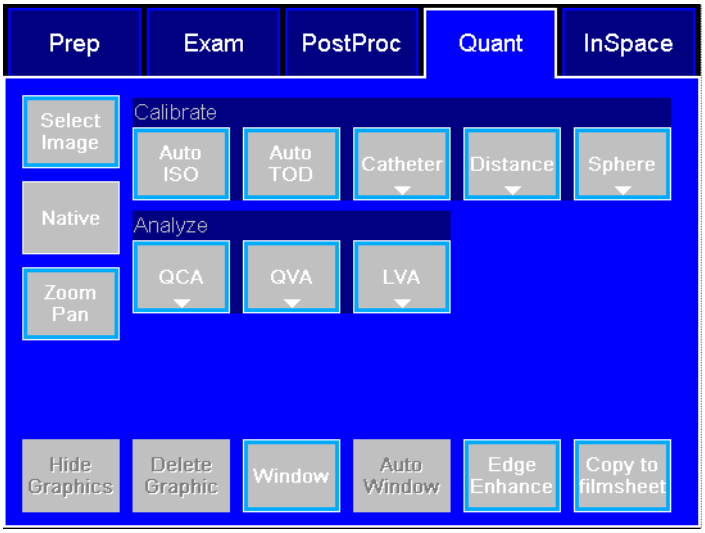


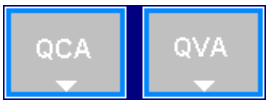
Pay attention to the messages at the bottom of the image.
They include notes for further operational steps.

At the touchscreen control

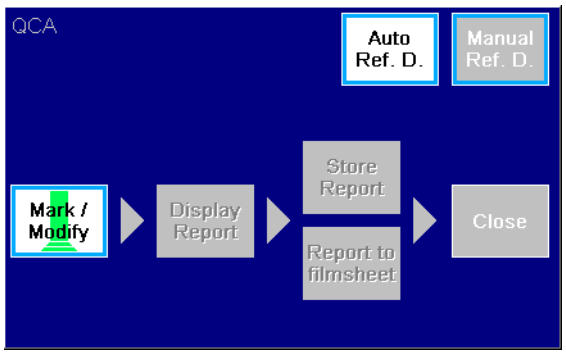
After you have calibrated the image, select the analysis method on the **Quant** task card.

◆ Activate the **Quant** task card, if necessary.





◆ Activate **QCA** or **QVA**.
– The **QCA** or **QVA** window appears.



Pay attention to the messages at the bottom of the image.
They include notes for further operational steps.

– The **Select image** selection field is briefly active,
then **Mark / Modify** is activated.

Do not move the joystick during this time.

If you now want to select another image, you must activate **Select image**.

Artery contour detection

Selecting the arterial segment

You must define the vascular segment you want to examine by drawing in an approximate center line. If the vessel is curved, a number of points (maximum 28) can be defined with a single click at the required positions. The line connecting these points must be within the vascular volume.

The center line must be marked *in the direction of blood flow* as this influences the calculation of the extent of stenosis. (The proximal and distal limits of the obstructed segment are calculated differently.)

To achieve reproducible analysis results, it is advisable to start and end the segment at a characteristic, conspicuous point. Side branches are suitable for this purpose.

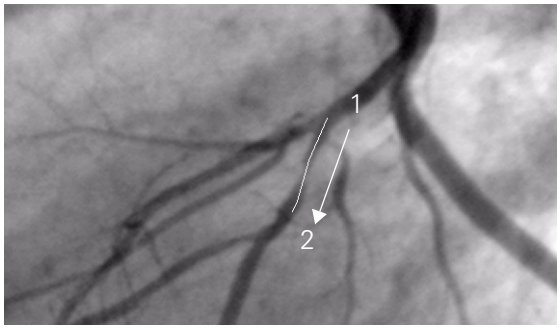
It can be helpful to enlarge the image region containing the vascular segment you want to analyze.

⇨ Chapter **General**, "Zooming/panning"

The calibration performed previously on the unzoomed image remains valid.

At the system console or at the touchscreen control

- Define the proximal starting point in the vessel with a **single click** (mouse) or the **function button** (IS joystick).
  – A line appears.
- Define any necessary intermediate points with a **single click** (mouse) or a **function button** (IS joystick).
  – The line changes its direction each time.



- Define the distal end point with a **double click** (mouse) or the **fire button** (IS joystick).
  – The contour is drawn.

Automatic contour detection

As soon as you have defined the arterial segment you want to examine with a center line, the contour detection algorithm automatically detects the vascular margins in two approximations.

❏ In the first step, the center line drawn is used for contour detection.

❏ In the second step, a new center line is defined on the basis of the contour determined in the first approximation.

With this method, the influence of the center line drawn by you is minimized in two steps, and an exact position is determined instead.

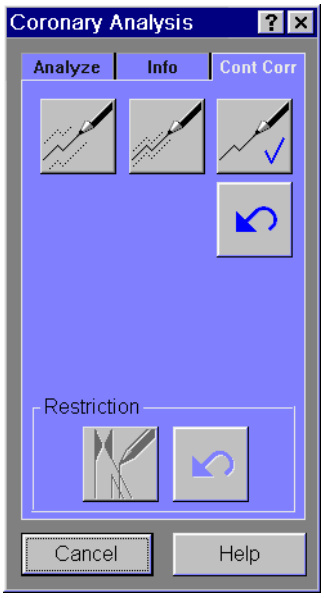
Manual contour correction

If the detected contour of the arterial segment is not satisfactory, you can make manual corrections.

Correction **At the system console or at the touchscreen control**

- Start the correction with a **single click** (mouse) or **function button** (IS joystick) at the point from which you want to correct the existing contour.
  – A line is drawn.

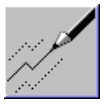
- Define the intermediate points along the required contour with a **single click** (mouse) or **function button** (IS joystick).
  – The line changes its direction each time.
- Define the end point with a **double click** (mouse) or **fire button** (IS joystick).
  – In the control room, the **Coronary Analysis** or **Vascular Analysis** window switches to the **Cont Corr** subtask card.



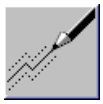
Smoothing

At the system console

In the control room, you can choose one of the following options:



❏ **Smooth**
The drawn contour is smoothed considerably.



❏ **Soft**
The corner points of the drawn contour are slightly smoothed.

If you select **Smooth** or **Soft**, the correction detection algorithm is activated and a search is performed to find an optimum contour in a region around the manually made correction.

The difference between **Smooth** and **Soft** is that the search in **Soft** covers a smaller region on both sides of the manually defined contour than in the case of **Smooth**.

❏ **Hard**
The drawn contour is unchanged.

◆ Click one or more times on the appropriate icon.

Or

◆ Reject your changes by clicking on this icon.

At the touchscreen control

In the exam room, the contour is automatically corrected with **Soft**.

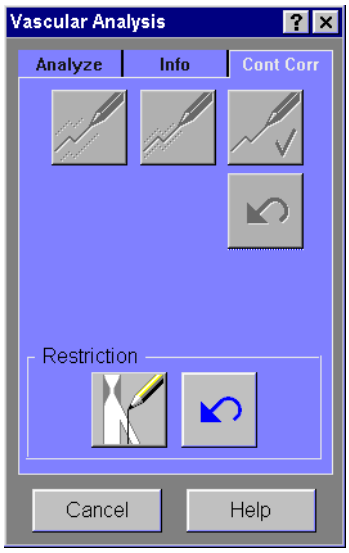
Manual restriction

If the defined contour is too large, you can trim the contour.

If you perform a further delimitation, the previous delimitation will be displayed.

At the system console or at the touchscreen control

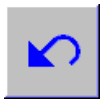
- Start outside the contour with a **single click** (mouse) or **function button** (IS joystick).
  – A line is drawn.
- Define the intermediate points inside the vessel with a **single click** (mouse) or **function button** (IS joystick).
  – The line changes its direction each time.
- Define the end point outside the vessel with a **double click** (mouse) or **fire button** (IS joystick).
  – In the control room, the **Coronary Analysis** or **Vascular Analysis** window switches to the **Cont Corr** subtask card.



At the system console

- Click on this icon.

Or



- Reject your changes by clicking on this icon.

Calling up and entering information about the contour

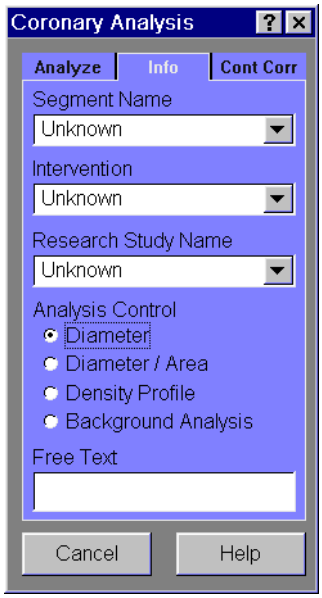
As soon as a contour is drawn in the image, diagrams will appear.
(default: diameter curve and densitometrically determined surface curve).

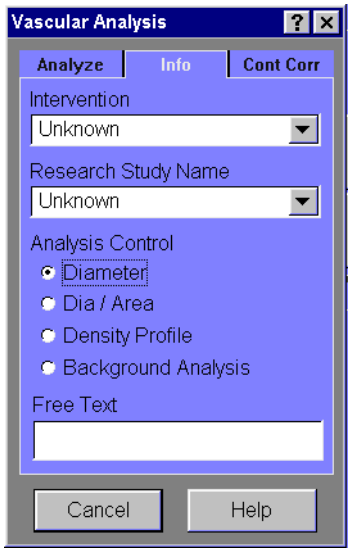
➪ Also see "Configuring QCA/QVA" on page 71

On the **Info** subtask card you can call up various curves and annotate them with text.

At the system console (only)

◆ Click the **Info** subtask card into the foreground.

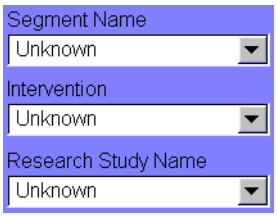




Naming curves

Using names

You can mark sections on the **Info** subtask card (only on the system console) with:

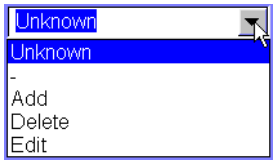


❏ a segment name (only QCA)

❏ a type of intervention

❏ a research study name

Processing names



◆ Select a name from the list.

Or

◆ Enter a new name.

◆ Select **Add**.
– The name is added to the list.

Or

◆ Select a name from the list.

◆ Change the name as required.

◆ Select **Edit**.
– The name is changed in the list.

Or

◆ Select a name from the list.

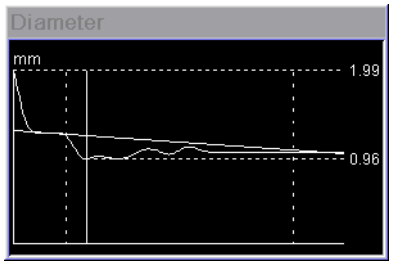
◆ Select **Delete**.
– The name is deleted from the list.

Entering a free text

◆ Enter the required text in the **Free Text** field.

Diameter

- Select **Diameter** (default) on the **Info** subtask card.
  – Only the diameter curve is displayed.



Diameter curve

The course of the vessel is drawn as a curve from left to right, corresponding to proximal to distal. The position of the *minimum lumen diameter* (**MLD**) is displayed by a vertical line and specified as a value on the right in the **Diameter** diagram. The maximum diameter value is shown above that.

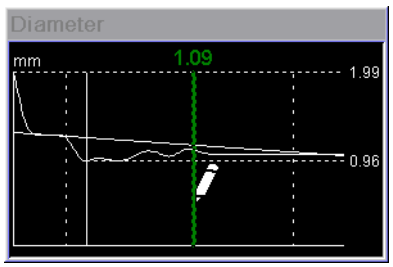
Moving the MLD line

If the MLD line does not appear in the expected position, e.g. in the case of an artery with more than one stenosis, you can shift it to the required position:

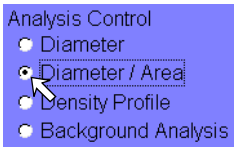
- Push the mouse pointer onto the MLD line in the **Diameter** *diagram*.
  – It changes shape to a double arrow.
- With the left mouse button / function key pressed, you can move the double arrow (and thus the line).

Displaying a local diameter

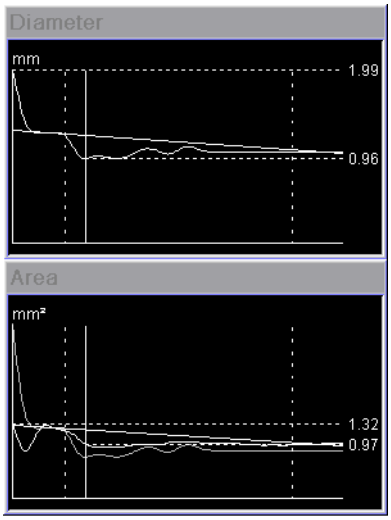
- The local diameter value is displayed above the diameter curve if you click on the **Diameter** *diagram*.
  – The position is shown as a dot in the vessel.



Diameter and area



- Select **Diameter/Area** on the **Info** subtask card.
  – The diameter and area curves are displayed.



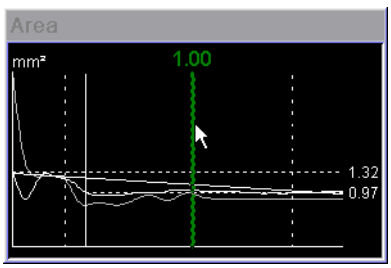
Area curve

The **Area** diagram shows two curves: a light one indicating the area in **mm²** or **Units** and a grey one showing the corresponding densitometrical values.

The course of the vessel is drawn as a curve from left to right, corresponding to proximal to distal. The position of the minimum, densitometrically determined cross-sectional area is indicated with a vertical line and shown on the right in the **Area** diagram as a value. The value of the maximum area is shown above that.

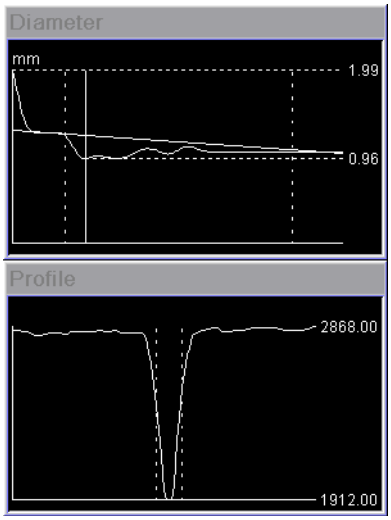
Displaying a local density

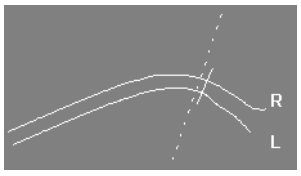
- If you click on the **Area** *diagram*, local density values are displayed above the area curve.
  – The position is shown as a dot in the vessel.



Density profile

◆ Select **Density Profile** on the **Info** subtask card.
– The diameter and density curves are displayed.



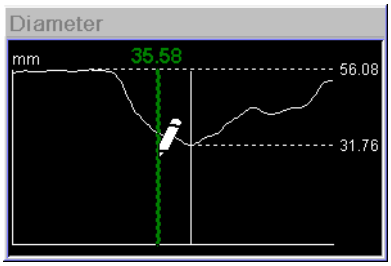


The grayscale value analysis of a vessel cross-section is also available.

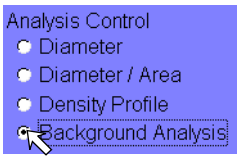
The **Profile** diagram shows the density and brightness at the position of the vessel corresponding to the position on the broken line in the image. The dashed lines in the **Profile** diagram indicate the edges of the vessel.

Analyzing another position

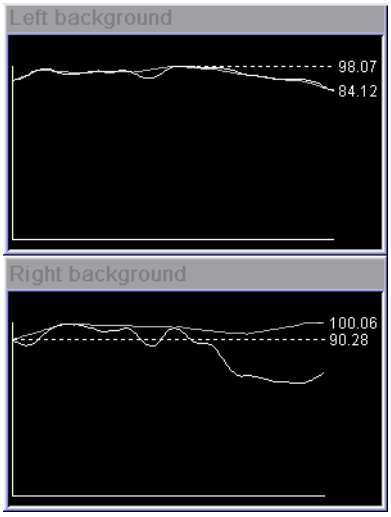
◆ Move the dashed line in the **Diameter** *diagram* holding the left mouse button / joystick function button down.
– The position is shown as a dot in the vessel.



Background analysis



- Select **Background Analysis** on the **Info** subtask card.
  – The background densities are displayed.



Background curves

The brightness of an image is influenced not only by the contrast medium in the vessel, but also by the tissue (bone) overlapping the vessel. To correct this background influence, the background brightness is subtracted.

The continuous curve indicates the background brightness. The smoothed gray curve takes into account the elimination of the effect of side branches. The latter is used for background correction.

In the image, the left and right vessel edges (with respect to the direction of blood flow) are marked with the letters **L** and **R**.

Performing analysis

You can select various analysis methods depending on the detected arterial contour.

All data of the stenosis calculation with a manually determined reference diameter are rejected if a stenosis calculation is performed with an automatically determined reference diameter and vice versa.
Only one method is valid. The reference information of the value used is also used to calibrate the results of the density calculation.

If the vessels are wide, DDO can reduce the accuracy while determining the density values, for example:

❏ 5 mm vessel, 17 cm image format, 80% DDO → Density value error: -17%

❏ 2 mm vessel, 17 cm image format, 80% DDO → Density value error: -3%

With more than 30% DDO, densitometric measurement is *no more reliable*.

Information about stenosis calculation

Lambert-Beer law

The ratio between the contrast medium quantity at a defined point in the vessel and the brightness at this point in the clinical image is taken as the basis for a densitometric calculation. This relationship is known as Lambert-Beer law.

The results of the densitometric calculation provide you with information about possible vessel asymmetry.

The anatomical background changes (e.g. if a vessel is projected over bones) or is simulated (e.g. if a vessel is u-shaped, it moves toward the observer, curves and moves away from the observer). This can cause misinterpretation by the observer.

But a lower contrast medium density in a vessel can also be caused by a stenosis.

That is why the density is corrected for "normal changes" of the background.

mm² ↔ units

The density curve is initially only calculated in "units". After a diameter calculation (with an automatically or manually determined reference diameter), a conversion factor (scaling factor) is calculated which states the relation between the density in the vessel (brightness) and the area (mm^2).

The brightness averaged over a cross-section of the artery is therefore a measure of the cross-sectional area. These values are stated in the area curve.

This calculation is automatically performed after a stenosis calculation with an automatically or manually determined reference diameter.

Until the brightness is calibrated to mm^2, the curve is stated in "units".

Stenosis calculation with automatically determined reference diameter

Based on the diameter calculated at the MLD position, a reference diameter for stenosis calculation is determined.

A second area curve is calculated and displayed based on the artery diameter D assuming a circular form for $^1/_4 \pi D^2$.

Possible differences between the two area curves indicate asymmetry in the plaque of the artery or create the illusion of other phenomena that affect density.

Automatic reference is the method to get the reference diameter at the same position as the stenotic diameter. It is based on computed reconstruction of the vessel. It results in the calculation of the stenotic length.

At the system console

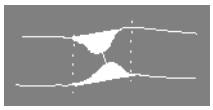
◆ Click on this icon.

At the touchscreen control

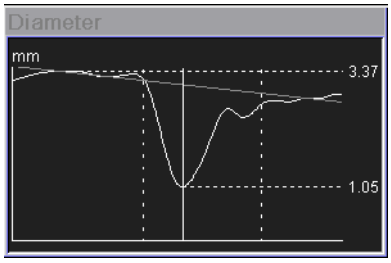
◆ Activate **Auto Ref.D.** on the **Quant** task card, **Stenosis** subtask card.

⇨ "Artery contour detection" on page 47

The stenosis is calculated on the basis of the reference diameter defined by the computer.



The results are displayed in the **Diameter** diagram.



The course of the vessel is drawn as a curve from left to right, corresponding to proximal to distal. The position of the minimum lumen diameter (MLD) is displayed by a vertical line and specified as a value on the right in the diagram. The maximum diameter value is shown above that.

The descending straight line represents the reconstruction line for the analyzed vascular segment determined by the computer. Its gradient is calculated on the basis of the diameters outside the stenotic region, so that 80% of all diameters are underneath this line.

The point of intersection of the reconstruction line with the line which also indicates the length of the MLD defines the length of the reference diameter.

Changing the position of the limits

If required, you can change the position of the limits by moving the marking lines in the diameter diagram:

- Move the mouse pointer onto one of the lines in the **Diameter** *diagram*.
  – The mouse pointer changes shape to a double arrow.

- Move the marking line by moving the double arrow holding the left mouse button/function button pressed.
  - The new position of the limit is fixed when you release the button.
  - The reconstruction line, parts of analysis results, and the plaque display are deleted.
  - The length of the stenotic segment is automatically recalculated and displayed.

It is not possible to place the distal limit at a point on the left of the MLD or the proximal limit at a point on the right of the MLD.

Each time you change the position of the MLD (minimum lumen diameter), the limits of the stenosis, the reconstruction line, parts of the analysis results, and the plaque display are deleted.

Then the limits must be recalculated because the position of the MLD also influences the position of the stenosis limits.

Stenosis calculation with manually determined reference diameter

If the position of the reference diameter D is changed, the results will be recalculated. Assuming the artery is circular, the reference area for $^1/_4 \pi D^2$ is calculated.

Because both the densitometric cross-sectional area and the area calculated with the diameter are based on the assumption of a circular artery, the reference diameter value is used to calculate and display the density in mm^2.

Manual reference is the method to place reference lines at any position in the analyzed segment.

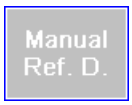
You can define whether you will determine one, two, or three reference diameters.

⇨ "Manual reference positions" on page 72

At the system console

◆ Click on this icon.

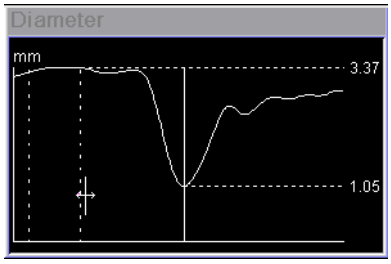
At the touchscreen control



◆ Activate **Manual. Ref.D.** on the **Quant** task card, **Stenosis** subtask card.

⇨ "Artery contour detection" on page 47

Stenosis calculation, based on a defined reference diameter, is started.
– The results are displayed in the **Diameter** diagram.



The diameter diagram shows dashed lines (1, 2, or 3 depending on configuration). They indicate the position of the reference diameters to be defined by you.

◆ Move the mouse pointer onto the appropriate dashed line in the **Diameter** *diagram*.
– It changes shape to a double arrow.

◆ With the left mouse button / function key pressed, you can move the double arrow (and thus the line).

However, the system corrects this position automatically to the local minimum. That means: The reference diameter defined by you and the area are calculated as the mean value of the selected diameter and all diameters in an area comprising 10 pixels around the reference position defined by you.

The position of the MLD is indicated again with the continuous line. The value on the right next to it indicates its length. The maximum diameter value appears above.

While you move the reference diameter, the corresponding position in the image is displayed as a white dot inside the vessel. If the position is changed, the results are recalculated and displayed.

Manual subsegment

You can measure a specific part of the artery. This subsegment is defined by a proximal and a distal limit.

A user defined subsegment can be used, if the marked segment shows several stenoses.

The method allows to analyze them individually and to calculate a mean value.

The method also provides a minimum diameter.

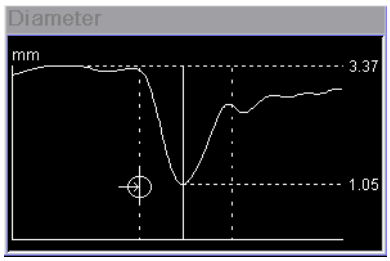
At the system console (only)

- Click on this icon.

⇨ "Artery contour detection" on page 47

- You can define the position of the subsegment by shifting the marks in the **Diameter** *diagram*.

  – The mouse pointer changes shape to an arrow with a circle.
  – As you shift the mark, the current position is displayed as a white dot in the image.
  – The results are displayed in the **Diameter** diagram.



If the position of the limits is changed, the analysis data of the selected arterial subsegment are immediately recalculated and displayed.

Local diameter (with QVA only)

With this analysis, you can define several diameters on a drawn contour, e.g. to measure aortic aneurysms.

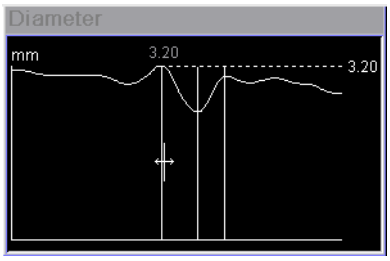
Local diameter measurement allows to determine up to 10 diameters along the analyzed segment.

At the system console (only)

- Click on this icon.
- Double-click on the position in the **Diameter** *diagram* at which you want to draw a diameter.

If you find that the line drawn is not in the correct position, you can move it:

- Position the mouse pointer on the line.
  – The mouse pointer changes shape to a double arrow.
- You can move the line by moving the double arrow while keeping the left mouse button pressed.
  – As you move the line, the diameter is displayed above the line and the current position is indicated in the image as a white dot.
  – The new position of the diameter line is fixed when you release the button.



Calling up analysis again

You can call up the last processed analysis of the same type as long as you do not restart the system or reregister a patient.

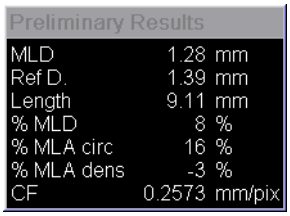
At the system console (only)

◆ Click on this icon on the **Analyze** subtask card.

Results (report)

Preliminary results

Preliminary results are displayed in the **Preliminary Results** window even during evaluation.



Generating a report

⇨ Chapter **General**, "Generating and storing a report"

Definitions

The QCA/QVA (output) parameters are explained on the following pages.

The following conventions have been used:

❑ Analysis parameters are shown in **boldface** type.

❑ The associated units are shown in square brackets [ ].

❑ **sdev** = standard deviation is the statistically determined variance around a mean value.

Parameters displayed

The contour and a list of numeric values for the analyzed vessel segment are displayed. They are:

Stenosis

- **MLD**: (Minimum Luminal Diameter) [mm]
  The minimum vessel diameter at the position of the most severe stenosis.
- **% MLD**: [%]
  Percentage of the minimum vessel diameter compared to the reference diameter: stenosis diameter/reference diameter x 100%
- **Stenotic length** [mm]
  Length of the analyzed vessel segment
- **Reference D.**: [mm]
  Diameter of the vessel at the reference point
- *MLA densitometric* (Minimum Luminal Area): [mm²]
  Densitometrically determined cross-sectional area at the location of the MLD
- **% MLA dens.**: [%]
  Densitometrically determined stenosis value relative to the reference value
- *MLA circular* (Minimum Luminal Area): [mm²]
  Cross-sectional area at the location of the MLD calculated using the circle formula assuming a round vessel cross-section
- **% MLA circ.**: [%]
  Stenosis value relative to the reference value calculated using the circle formula

Diameter

- **Min** [mm]
  Minimum diameter of the vessel segment
- **Max** [mm]
  Maximum diameter of the vessel segment
- **Mean** [mm]
  Mean diameter of the vessel segment
- **Mean standard dev.** [mm]
  Standard deviation of the mean diameter in the vessel segment

Area

- **Min** [units or mm²]
  Minimum cross-sectional area of the vessel segment
- **Max** [units or mm²]
  Maximum cross-sectional area of the vessel segment
- **Mean** [units or mm²]
  Mean cross-sectional area of the vessel segment
- **Mean standard dev.** [units or mm²]
  Standard deviation of the mean cross-sectional area in the vessel segment

Area formula

A vessel can have - compared with its anatomical background -
- a lower contrast density, for example, because of a stenosis,
- a higher contrast density, for example, because of superimposition of an object such as a rib or a different vessel.

- **... dens.** (densitometric) [units]
  The program takes account of the background with a densitometric analysis. You can use this background information to interpret the results correctly.

With more than 30% DDO, densitometric measurement is *no more reliable*.

- **... circ.** (circular) [mm²]
  It is assumed that the vessel is circular at the reference point and therefore its area is ¼ π D².
  This is correct if there is no pathological change at that point. The density at this point is considered to be the surface density. In other words: A vessel with diameter x mm has a surface density of y. The diameter and density are correlated.

If the *reference point is defined by the computer*, it is assumed that everything outside the stenosis is not pathological and therefore circular. Therefore, this is used to place the curves in relation to one another.

If a different reference point is chosen, and this is a pathological or non-circular vessel, the outcome will be untrue. The correlation between the two curves will be incorrect.

Miscellaneous

- **Symmetry**:
  Symmetry indicator for pathology; relation between plaque thickness and maximum plaque thickness of the vessel.
  A value of 1.0 means identical plaque thickness on both sides of the vessel wall, a value of 0.0 means maximum asymmetrical distribution.
- **Position Ref D.**: [mm]
  Position of the reference point measured from the starting point of the segment
- **Position prox.**: [mm]
  Distance from the proximal segment to the proximal limit, calculated from the initial marking; used for reproducibility.
- **Corrected**: Yes/No
  Manual correction of the contour
- **Pixel size**:
  Pixel size determined by calibration
- **Calibration object**:
  Method used for calibration
- **Calibration object size**:
  Diameter of the object used for calibration

Local Diameter (QVA only)

- **Index**:
  Consecutive numbering of the drawn diameters
- **Diam pos**: [mm]
  Position of the drawn diameter measured from the beginning of the contour
- **Diameter**: [mm]
  Diameter of the vessel
- **Area circ./dens.**: [mm^2]
  Area of the vessel

Results of the hemodynamic data

The following data appear as the result of a hemodynamic analysis:

Influence of stenosis on distal blood flow

Not only the degree of stenosis but also its form and length have an effect on the distal tissue.

A 20% stenosis with a "smooth" Gaussian curve form, for example, has less serious consequences on distal blood saturation than a square form. This results from turbulence in the blood before and after the stenosis.

With the Poisseuille algorithm it is possible to calculate the resistance of the blood flow as "R_{pois}" on the basis of the form and length of the stenosis.

The turbulence resistance caused by the form of the stenosis is calculated as "R_{turb}".

To simplify the calculations, some assumptions are made, for example, regarding the viscosity of the blood.

- **Flow**: [ml/s]
  Blood flow rate in the vessel
- **R_{pois}**: [mmHg s/ml]
  The Poisseuille resistance value based on the form and length of the stenosis, calculated using the following formula:

$$R_{pois} = \frac{C_1 \cdot (\text{extent of the stenosis})}{(\text{area of the stenosis})^2}$$

C1 = 8 x π x blood viscosity; a value of 0.03 g·s/cm² is assumed for blood viscosity

- **R_{turb}**: [mmHg s/ml]
  Turbulence resistance calculated with the following formula:

$$R_{turb} = C_2 \times \left(\frac{1}{\text{area of the stenosis}} - \frac{1}{\text{normal distal area}}\right)^2$$

C2 = blood density / 0.266; a value of 1.0 g/cm³ is assumed for the blood density

- **P_{grad}**: [mmHg s/ml]
  Pressure difference before and after the stenosis

It is calculated with the following formula:

$P_{grad} = Q \cdot R_{pois} + Q^2 \cdot R_{turb}$

Q = blood flow rate in ml/s

❑ **(Not) Corrected for cross-sectional area of cath.**: [mm²]
The catheter in the vessel influences the blood flow, that is, turbulences arise behind the catheter. The extent of this influence depends on the size and length of the catheter; the larger the catheter, the greater the influence on the blood flow.

If these values do not match those measured during the examination with a pressure sensor, you will have to change the set value of the cross-sectional area of the catheter used:

◆ Select **Quant > Configuration** from the menu.

◆ Select the **QCA** or **QVA** subtask card there.

◆ Specify the correct cross-sectional area and click on **OK**.
– The pressure gradient is calculated immediately with and without correction for the cross-sectional area taken up by the catheter.

⇨ "Configuring QCA/QVA" on page 71

❑ **Stenotic length (normal)**: [mm]
Length of the stenosis defined by the computer

❑ **Stenotic length (MinD + 10%)**: [mm]
Length of the stenosis calculated on the basis of the intersection points of the MDL +10% with the vessel edge

❑ **1.0**; **2.0**,...
Indicators for the severity of the pathological changes with reference to the load capability of the patient.
The numbers representing stenotic flow reserve (SFR) can be interpreted as follows:
– **5.0**: The pathological change has no effect on the resilience of the patient;
– **1.0**: The patient can not be exposed to great load because of the severity of the vascular disease and must "lie quietly in bed". A higher load causes lack of oxygen in the distal tissue.

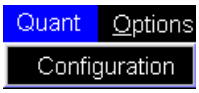
❑ **In-flow angle**: [degree]
Mean increase of the diameter between the position of the smallest stenosis diameter and the position of the proximal limit of the stenotic segment

❑ **Out-flow angle**: [degree]
Mean increase of the diameter between the position of the smallest stenosis diameter and the position of the distal limit of the stenotic segment.

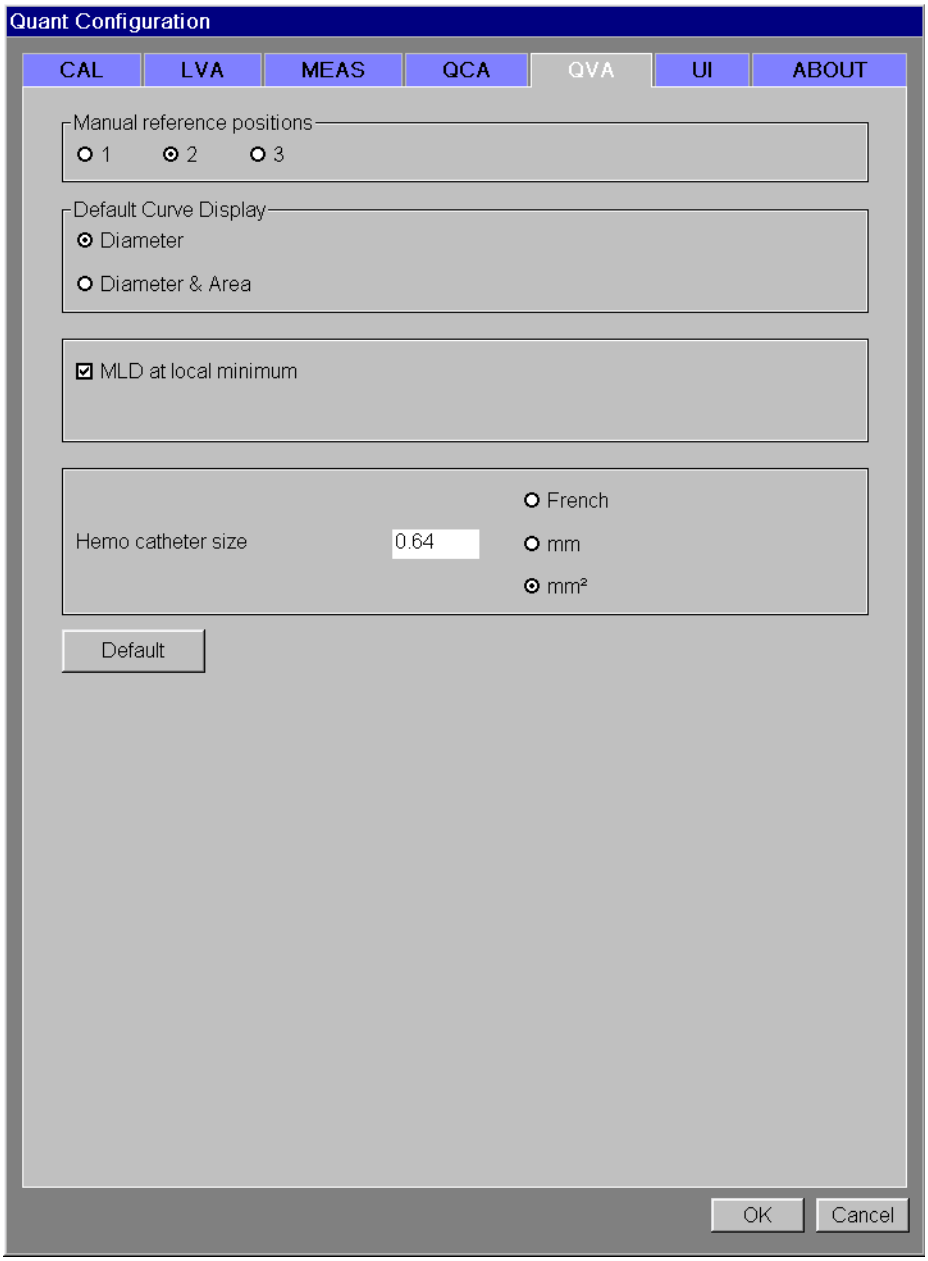
Configuring QCA/QVA

You can define a few settings for vascular analysis:

At the system console (only)



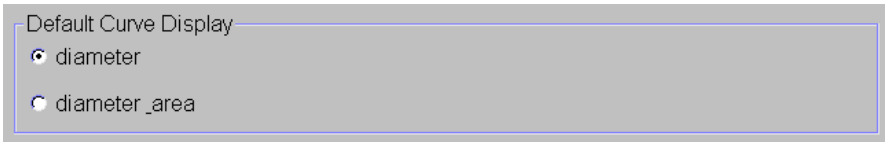
- Select **Quant > Configuration** from the menu.
  – The **Quant Configuration** window is displayed.
- Click the **QCA** or **QVA** subtask card into the foreground.



Manual reference positions

- Select the required number of possible manual reference positions.

Setting for diagrams

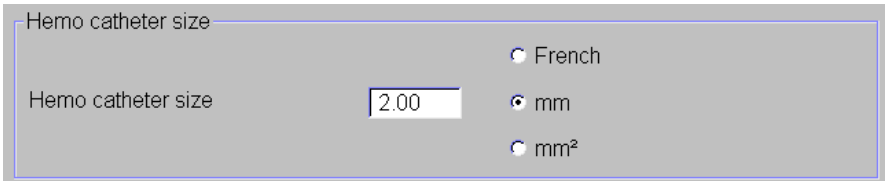


- Select whether only the diameter curve or the diameter curve and the area curve should be displayed.

Setting for calculation and display

- Select whether the MLD is to be calculated at a local minimum.

Hemo catheter size



- Select the value for the hemo catheter size and the units.

Closing the window

⇨ Chapter **General**, "Closing default settings"

Quantitative Ventricular Analysis (LVA)

Important notes

The left ventricular analysis software (LVA) was developed for analyses of the left ventricle of the heart in a 30° RAO projection (in plane A) or for biplane analyses in a 60° LAO projection in plane B.

The cardiac phases which are of most interest are the end diastole (= **ED**) and end systole (= **ES**) phases. If you use these phases, you can calculate several values, e.g. ejection fraction (**EF**).

The formulas for volume correction (regression formulas) are based on the left ventricle form in the 30° RAO projection (in plane A) or 60° LAO projection in plane B
If the projection deviates from this projection, the results may be less reliable!

- Please ensure correct 30° RAO projection (in plane A) or 60° LAO projection in plane B

All evaluation parameters depend on correct inputs. Changing the angulation changes the dimensions of the ventricle, which leads to incorrect results. The greater the deviation from 30° RAO or 60° LAO, the less reliable the results.

The permitted deviation from this projection is configurable.

⇨ "Permitted rotation range" on page 102

Starting analysis

Selecting a scene

- Load a suitable scene from the **Patient Browser** onto the **Quant** task card by drag-and-drop or a double click.

⇨ Part **Image Viewing and Image Processing**, Chapter **General**, "Loading a scene/image"

Calibration

Before you can perform quantitative ventricular analysis, you must calibrate the scene.

Make sure that the calibration object and the ventricle have the same geometric acquisition parameters, that is,

- ❏ the same focus-to-object and object-to-I.I./FD distances
- ❏ the same I.I./FD size
- ❏ the same stand positions
- ❏ the same image matrix

Otherwise the results will be less reliable.

For calibration, use an object with almost the same size as the object to be measured.

We recommend performing analysis with sphere calibration. This provides the best results.

⇨ Chapter **Calibration**

Selecting the analysis method

Depending on the installation, some analysis methods may not be available to you.

If the deviation from the 30° RAO projection is impermissibly large, it is not possible to select LVA.

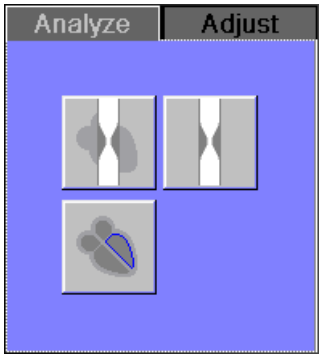
⇨ “Permitted rotation range” on page 102

Make sure that you have entered **Height** and **Weight** of the patient before you start **LVA**. If not, the **Index** values will not be available.

At the system console

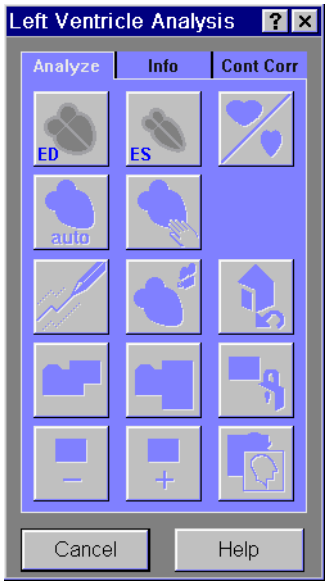
After you have calibrated the image, select the analysis method on the **Analyze** subtask card.

	LVA	quantitative analysis for determining the wall motion of the *left* cardiac ventricle



- Click the **Analyze** subtask card to the top, if necessary.

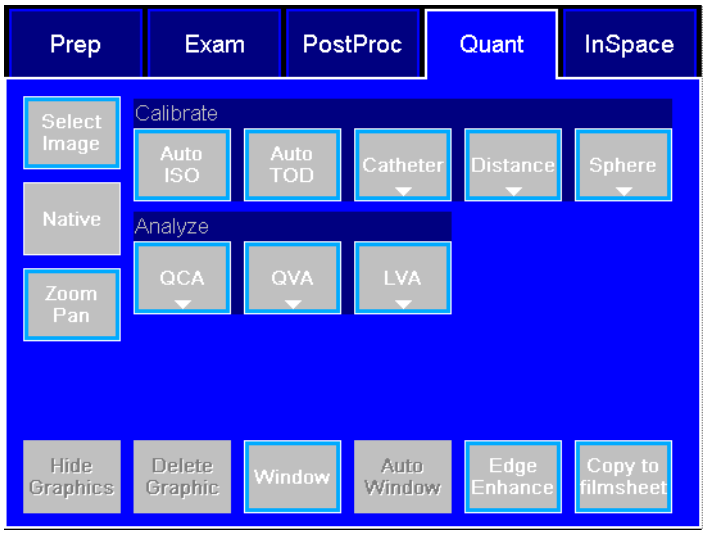
- Click on the icon (**LVA**) on the **Analyze** subtask card.
  - The **LeftVentricle Analysis** window with the **Analyze**, **Info** and **Cont Corr** subtask cards appears.



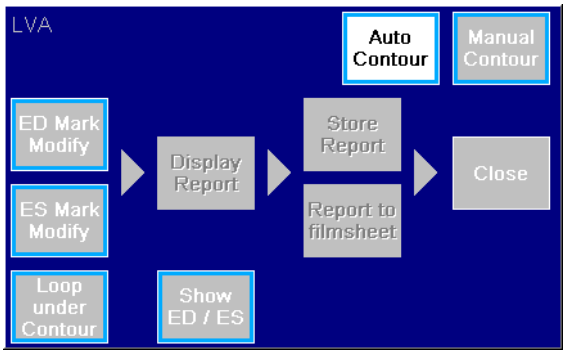
At the touchscreen control

After you have performed calibration, select the analysis method on the **Quant** task card.

◆ Activate the **Quant** task card, if necessary.



◆ Activate **LVA**.
– The **LVA** window appears.



A message appears at the bottom of the image.

Pay attention to the messages at the bottom of the image.
They include notes for further operational steps.

As soon as you move the cursor inside the image, it changes shape to a pencil.

Selecting images

The images for defining the contours of the ventricle wall can be analyzed in any order. However, we recommend starting by selecting the calibration image and calibrating it, then selecting the ED image and performing ED contour detection and, finally, selecting the ES image and performing ES contour detection.

Before defining a contour, you *must* mark the selected image as an ED (end diastolic) or ES (end systolic) image.

Defining the ED image

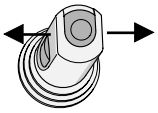
At the system console

◆ Click on a single step button.

◆ Click on this icon when you find a suitable ED image.

At the touchscreen control

ED Mark Modify is already active.



◆ Tilt the IS joystick briefly.

◆ Press a **selection button** ("fire button") on the top or rear of the joystick when you find a suitable ED image.

Defining contours ⇨ "Defining contours" on page 81

Defining the ES image

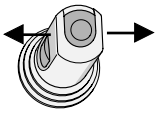
At the system console

◆ Click on a single step button.

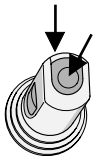
◆ Click on this icon when you find a suitable ES image.

At the touchscreen control

◆ Activate **ES Mark Modify**.



◆ Tilt the IS joystick briefly.



◆ Press a **selection button** ("fire button") on the top or rear of the joystick when you find a suitable ES image.

Defining contours ⇨ “Defining contours” on page 81

Biplane LVA

For images acquired in both planes on a biplane system, you can also perform biplane analysis.

For biplane LVA, *both* planes must be calibrated first.

Biplane LVA must be evaluated on image pairs for ED and ES:

❏ First draw both ED contours in plane A and B.

❏ Then draw both ES contours in plane A and B.

Contour acquisition is then performed in both planes and the system takes account of both contours around the ventricular volume.

If the deviation from the 30° RAO / 60° LAO projection is impermissibly large, it is not possible to select LVA.

⇨ "Permitted rotation range" on page 102

The software does not distinguish which plane is the frontal plane and which the lateral plane. LVA is possible in every configuration.

On an Artis (d)BC, the I.I./FD of the top stand is mounted to the left of the patient.

For this reason, plane A is used for the 30° RAO projection and plane B is used for the 60° LAO projection for LVA acquisitions.

On an Artis (d)BA on which the I.I./FD of the top stand is mounted to the left of the patient, plane A is used for the 30° RAO projection and plane B is used for the 60° LAO projection for LVA acquisitions.

The system also takes account of flipping to compensate for head-feet image reversal.

On an Artis (d)BA on which the I.I./FD of the top stand is mounted to the right of the patient, LVA is possible by swapping the planes around: plane B is used for 30° RAO projection and plane A for 60° LAO projection.

At the system console

- Click on the icon on the **Analysis** subtask card to start the analysis.
- Click into the plane A image.

- Define the ED image pair.
- Define the contour in plane A and correct the contour, if necessary.
- Click into the plane B image.
- Define the contour in plane B and correct the contour, if necessary.

- Click into the plane A image again.

- Define the ES image pair.
- Define the contour in plane A and correct the contour, if necessary.
- Click into the plane B image.
- Define the contour in plane B and correct the contour, if necessary.

At the touchscreen control

- Activate **LVA** to start the analysis.

- Define the ED image pair.
- Define the contour in plane A and correct the contour, if necessary.

- Activate **A/B** on the left of the card stack.
- Define the contour in plane B and correct the contour, if necessary.

- Activate **B/A** on the left of the card stack.

- Define the ES image pair.
- Define the contour in plane A and correct the contour, if necessary.

- Activate **A/B** on the left of the card stack.
- Define the contour in plane B and correct the contour, if necessary.

Defining contours

The ventricle contours serve as the basis for calculating the results of the analysis. There are two ways of defining the contours for the end diastole and end systole: either manually or by drawing in the valve plane and the apex followed by automatic contour detection.

You can also draw the wall contour to determine the data of the ventricle wall.

Automatic contour detection

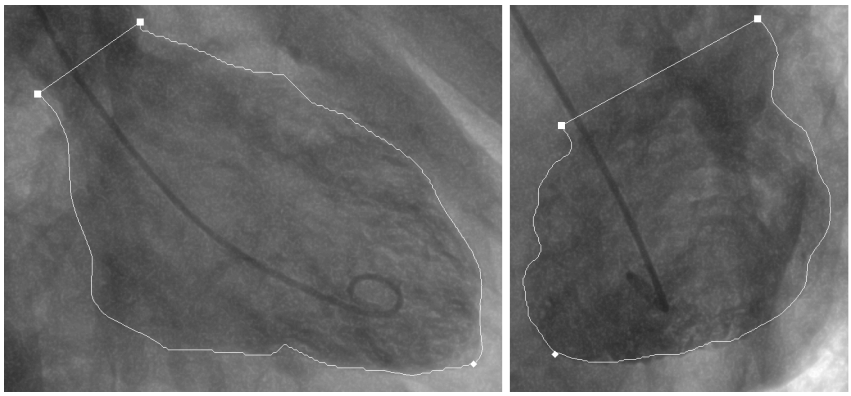
Starting **At the system console or at the touchscreen control**

As soon as you have selected an ED or ES image, automatic contour detection is activated.

– The mouse pointer changes shape to a square.

Aortic valve First define the position of the aortic valve with a line:

- Click on a point on the edge of (outside) the aortic valve in a line with the valve plane.
- Click on a point on the opposite side of the aortic valve.
  – The points marking the valve plane are indicated by squares.



Apex Now define the position of the apex:

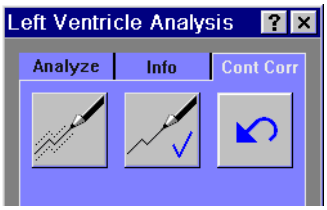
- Click on the apex.
  – This point is also indicated by a square.
  – The contour is drawn.

Correction

At the system console or at the touchscreen control

If the detected contour of the ventricle is not satisfactory, you can make manual corrections.

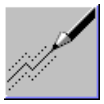
- Move the mouse pointer *close* to the contour you want to modify.
- Start the correction with a **single click** (mouse) or **function button** (IS joystick) at the point from which you want to correct the existing contour.
  – A line is drawn from this point.
- Define the intermediate points along the required contour with a **single click** (mouse) or **function button** (IS joystick).
- Define the end point with a **double click** (mouse) or **fire button** (IS joystick).
  – In the control room, the **Left Ventricle Analysis** window switches to the **Cont Corr** subtask card



Smoothing

At the system console

In the control room, you can choose one of the following options:



❑ **Soft**
The corner points of the drawn curve are smoothed.

If you select **Soft**, the correction detection algorithm is activated and a search is performed to find an optimum contour in a region around the manually made correction.

❑ **Hard**
The drawn contour is unchanged.

- Click one or more times on the appropriate icon.

Or

- Reject your changes by clicking on this icon.

At the touchscreen control

In the exam room, the contour is automatically corrected with **Soft**.

Aortic valve and/or apex

At the system console or at the touchscreen control

You can change the positions of the aortic valve and the apex. This also changes the contour you defined previously.

- When you move the mouse pointer near the points, the pointer turns into a square, and you can change the position of the point by pressing the mouse button and dragging the square to the desired position.
- Start a new contour acquisition with a **double click** (mouse) or **fire button** (IS joystick).

Defining a contour manually

The prerequisite is that an image has been defined as ED or ES image.

Starting

At the system console

- Click on this icon.

At the touchscreen control

- Activate **Manual Contour** on the **Quant** task card, **LVA** subtask card.
  - As soon as you move the mouse pointer into the image, it changes shape to a square.
- Move the mouse pointer onto the upper point of the aortic valve and perform a **single click** (mouse) or press the **function button** (IS joystick).
  - A line is drawn.

- Move the mouse pointer clockwise along the edge of the ventricle, defining intermediate points with a **single click** (mouse) or the **function button** (IS joystick)
  – The line changes its direction each time.
- Mark the lower edge of the aortic valve with a **double click** (mouse) or the **fire button** (IS joystick).
  – The contour is drawn.

At the end of the manual contour definition, the valve plane will be indicated by a line which connects the upper and lower points of the aortic valve. These points are indicated as small squares.

Correction **At the system console or at the touchscreen control**

You can correct the contour which has been drawn.

- Move the mouse pointer *close* to the contour you want to modify.
- Start the correction with a **single click** (mouse) or **function button** (IS joystick) at the point from which you want to correct the existing contour.
  – A line is drawn from this point.
- Define the intermediate points along the required contour with a **single click** (mouse) or **function button** (IS joystick).
  – The line changes its direction each time.
- Define the end point with a **double click** (mouse) or **fire button** (IS joystick).
  – The line is drawn.

Smoothing **At the system console**

- Click once or several times on this icon.
  – The edges are smoothed.

Aortic valve **At the system console or at the touchscreen control**

The aortic valve position can also be changed. When the mouse pointer comes near the valve points, the pointer changes shape to a square.

- You can change the position of each valve point by dragging the square to the required position while holding the **left mouse button** or **function button** pressed.
- A **single click** (mouse) or the **function button** (IS joystick) fixes this position.

After you have changed the aortic valve position, the valve points are automatically connected to the contour again by a line. This line connects the valve points to the nearest point on the contour.

Drawing the wall contour

If you want to determine not only the data of the ventricle but also the data of the ventricle wall, draw the outer ventricle wall contour, too, after you have drawn the ventricle contour or corrected it.

You can do this either at a specific point, over a short section, or for the entire ventricle wall.

At the system console or at the touchscreen control

- Push the mouse pointer *away* from the ventricle contour to the outer ventricle wall. (If you move the mouse pointer away from the ventricle contour, "the pencil flickers" briefly.)
- Start with a **single click** (mouse) or the **function button** (IS joystick).
- Define the intermediate points along the required contour with a **single click** (mouse) or **function button** (IS joystick).
- Define the end point with a **double click** (mouse) or **fire button** (IS joystick).

Checking the contour

Loop

You can check whether you have selected the correct image more easily in the dynamic display, that is, if the heart is beating under the contour (provided a contour has already been drawn).

At the system console

◆ Click on this icon.

At the touchscreen control

◆ Activate **Loop und. Contour** on the **Quant** task card, **LVA** subtask card.

The scene is replayed dynamically under the contour.

ED/ES

As an alternative you can also switch between ED and ES (provided an ED and an ES image have already been selected).

At the system console

◆ Click on this icon once or several times.

At the touchscreen control

◆ Activate **Show ED/ES** on the **Quant** task card, **LVA** subtask card.

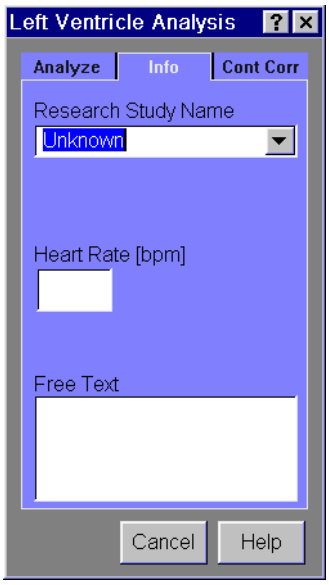
The ED and the ES images are displayed alternately.

Annotating a contour

On the **Info** subtask card you can define the heart rate and annotate the contour with texts.

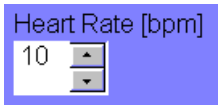
At the system console (only)

- Click the **Info** subtask card into the foreground.



Changing the review heart rate

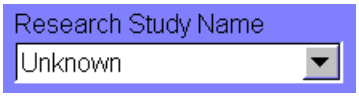
In order to get a **Cardiac Output**, you must enter a **Heart Rate**.



- Enter the required heart rate in the **Heart Rate** field or use the spin buttons.

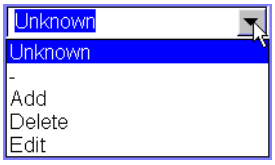
⇨ Also see “Configuring LVA” on page 100

Using names



You can name the contour with a research study name.

Processing names



- Select a name from the list.

Or

- Enter a new name.
- Select **Add**.
  – The name is added to the list.

Or

- Select a name from the list.
- Change the name as required.
- Select **Edit**.
  – The name is changed in the list.

Or

- Select a name from the list.
- Select **Delete**.
  – The name is deleted from the list.

Entering a free text

- Enter the required text in the **Free Text** field.

Calling up analysis again

You can call up the last processed analysis of the same type as long as you do not restart the system or reregister a patient.

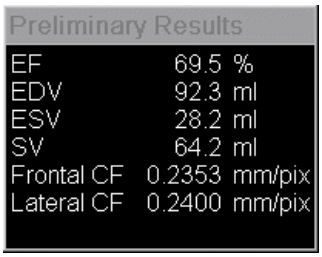
At the system console (only)

- Click on this icon on the **Analyze** subtask card.

Results (report)

Preliminary results

Preliminary results are displayed in the **Preliminary Results** window even during evaluation.



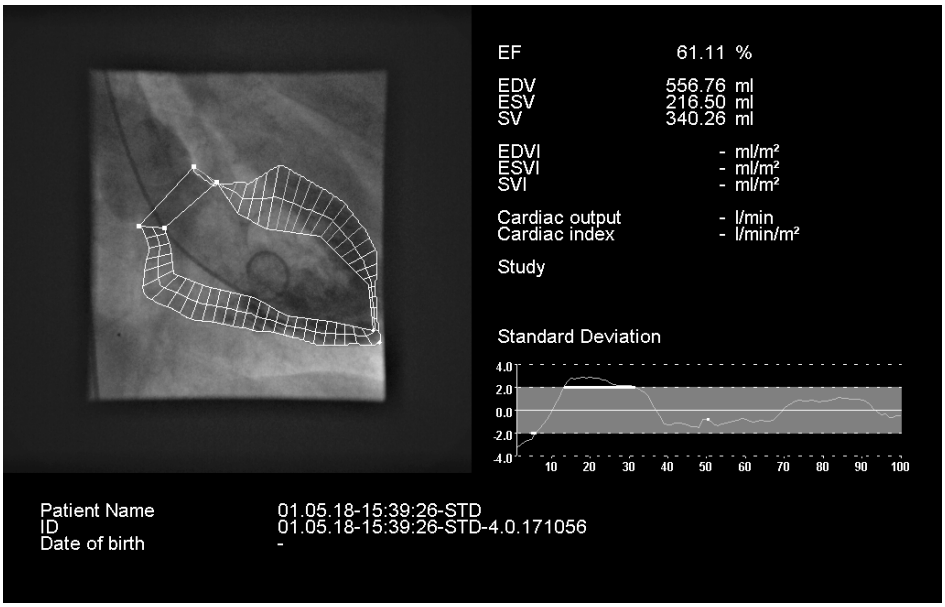
Generating a report

⇨ Chapter **General**, "Generating and storing a report"

Report

The report consists of several fields:

- ❏ Image with the drawn contours
- ❏ Data fields
- ❏ Curves



Example of a normal report

Definitions The LVA (output) parameters are explained on the following pages.

The following conventions have been used:

- Analysis parameters are shown in **boldface** type.
- The associated units are shown in square brackets [ ].
- **sdev** = standard deviation is the statistically determined variance around a mean value.

General parameters

- **Patient name**
  Name of the patient as he or she is registered in the system
- **ID**
  Patient ID
- **Date of birth** [DD/MM/YYYY]
  Date of birth of the patient

- **Frontal CF**:
  Calibration factor in the frontal plane
- **Calibration object**:
  Method used for calibration
- **Calibration object size**:
  Diameter of the object used for calibration

The method used for volume calculation and the regression constants used are displayed for the ED and ES volume.

❏ **Volume method**
Algorithm used for calculating the volume:
– **Simpson** (slice addition method)
A stack of thin slices models the ventricle. The volume is calculated for each slice, using the thickness and diameter. The sum of all slices yields the ventricle volume.
Volume = $\Sigma \pi D_i^2 /4 h_s cal^3$
D_i = slice diameter
h_s = slice height
cal = calibration factor
For more details, please see ref. 1. in the bibliography.
– **Area length**
The ventricle is assumed to be an ellipsoid.
Volume = $8/3 \pi A^2 / L cal^3$
A = area of ventricle in pixels
L = length of the long semi-axis (in pixels)
cal = calibration factor
For more details, please see ref. 3. in the bibliography.

The volume method used for single plane operation can be changed.

In biplane operation, the area length method is always used.

⇨ "Configuring LVA" on page 100

If the calibration is not performed correctly, the error in the calculation is raised to a power of three!
That means, by rule of thumb, that the resulting error is three times greater than the original error. A calibration error of e.g. 5% results in an overall error of about 15% (since $(1+\Delta x/x)^3 \approx 1 + 3\Delta x/x$).

The resulting volume must be corrected with the appropriate regression formulae in order to calculate the ventricle volume.

❏ **EDV regression**: · X

❏ **ESV regression**: · Y

X and Y are the formulae used

⇨ "Regression formulae" on page 92

Regression formulae

The volume calculated as an initial estimate must be corrected with a correction formula to determine the correct left ventricle volume.

Various volume correction formulae can be found in specialist literature to correct the end diastolic and end systolic volumes.

Various regression formulae are available for the area length method and the Simpson method.

Predefined regression formulae

Area length (single plane) [ml]	**Simpson (single plane) [ml]**
$EDV_{cor} = 0.783 \cdot EDV_{calc} - 3.759$ $ESV_{cor} = 0.783 \cdot ESV_{calc} - 3.759$ "Reiber" formula ⇨ Ref. 5. in the bibliography.	$EDV_{cor} = 0.737 \cdot EDV_{calc} - 4.649$ $ESV_{cor} = 0.737 \cdot ESV_{calc} - 4.649$ "Reiber" formula ⇨ Ref. 5. in the bibliography.
$EDV_{cor} = 0.810 \cdot EDV_{calc} + 1.900$ $ESV_{cor} = 0.810 \cdot ESV_{calc} + 1.900$ "Kennedy" formula ⇨ Ref. 2. in the bibliography.	$EDV_{cor} = 0.849 \cdot EDV_{calc} - 3.920$ $ESV_{cor} = 0.849 \cdot ESV_{calc} - 3.920$ ⇨ Ref. 4. in the bibliography.
$EDV_{cor} = 0.822 \cdot EDV_{calc} - 4.649$ $ESV_{cor} = 0.585 \cdot ESV_{calc} - 4.649$ If the same contour is used for EDV and ESV, two different volumes will result and the ejection fraction (EF) will differ from zero. ⇨ Ref. 6. in the bibliography.	

Area length (biplane) [ml]	**Simpson**
$EDV_{cor} = 0.989 \cdot EDV_{calc} - 8.100$ $ESV_{cor} = 0.989 \cdot ESV_{calc} - 8.100$ ⇨ Ref. 7. in the bibliography.	

Changing the regression formula directly affects the results.
The results could then have less, or even no, clinical relevance.

◆ Pay attention to the regression formula.

The regression formula used can be changed.

⇨ "Configuring LVA" on page 100

User-defined regression formula

And finally, you can also use your own formula for volume correction:

User-defined formula (single plane and biplane)	
$EDV_{cor} = a \cdot EDV_{calc} + b$ $ESV_{cor} = c \cdot ESV_{calc} + d$	a, b, c, d : defined constants

Here you are free to define your own optimal formulae for correcting the EDV and ESV. These factors may differ from those used in various volume calculation methods.

When using regression factors other than those prescribed, the calculated LV volume can be incorrect.
The physician is responsible to select the correct regression formula dependant from the needs.

◆ Only use the prescribed regression factors, if possible,
or select them carefully.

If only the EF percentage is required (no volumes etc.), calibration is not necessary. The user-defined formula should be selected with a gradient of a=c=1 and an offset of b=d=0, both for ED and ES.

Analysis parameters

A number of results are calculated on the basis of the contour data in the ED and ES image field and the pixel size.

The scene and frame number of the image as well as the volume and the indexed volume are shown directly above the image.

The ED and ES volumes are calculated with the formula of the selected volume model on the basis of the contour and the calibration factor.

The volumes are corrected with the selected regression formula.

After the calibration factor has been calculated and the ED and ES images imported into the report, all other parameters in the report are calculated by the computer.

- **EF** (Ejection Fraction)
  Ejection fraction = ratio of the difference between EDV and ESV and the EDV as a percentage: 100% x (EDV-ESV) / EDV
- **EDV** [ml]
  Volume of the ventricle in the ED phase
- **ESV** [ml]
  Volume of the ventricle in the ES phase
- **SV** [ml]
  Stroke volume of one heart beat, result of EDV-ESV
- **EDVI**
  Ratio of the ED volume and index parameter
- **ESVI**
  Ratio of the ES volume and index parameter
- **SVI** [ml/m^2 or ml/kg]
  Ratio of the stroke volume and the selected index parameter; BSA, $BSA^{1.219}$ or weight
- **Cardiac output** [l/min]
  Cardiac output per minute = stroke volume x heartbeats per minute
- **Cardiac index** [l/min / m^2]
  The cardiac output is always indexed with the body surface area (BSA).
  = cardiac output/BSA
  The index method cannot be changed for this parameter.
- **Heart rate** [beats per minute]
  Heart rate of the patient

Index method

BSA, **BSA**$^{1.219}$ or **weight**

The volume values are placed in relation to the body surface area (or the weight) so that the LV analysis results can be compared with a normal function. To take account of growth, the body surface area of children is raised to the power of 1.219.

⇨ For more details, please see ref. 6. in the bibliography.

You can select the index method with BSA, BSA$^{1.219}$.

⇨ "Configuring LVA" on page 100

❑ **BSA** [m²]
The BSA (= Body Surface Area) is calculated from the height and **weight** of the patient (entered during **patient registration**).

Wall parameters

If the wall contour was drawn in addition to the ventricle contour, the following parameters will also appear:

❑ **Wall thickness**
Average thickness W_T of the ventricle wall calculated from the ventricle contour and the additionally drawn outer ventricle wall contour.

❑ **Wall volume**
Volume W_V of the ventricle wall calculated by the elypse method

❑ **Wall mass**
Wall mass W_M calculated by the formula $W_M = 1.05 * W_V$.

❑ **Wall load**
Wall load W_S of the ventricle wall calculated by the elypse method

⇨ For more details, please see ref. 11. in the bibliography.

Wall motion analysis

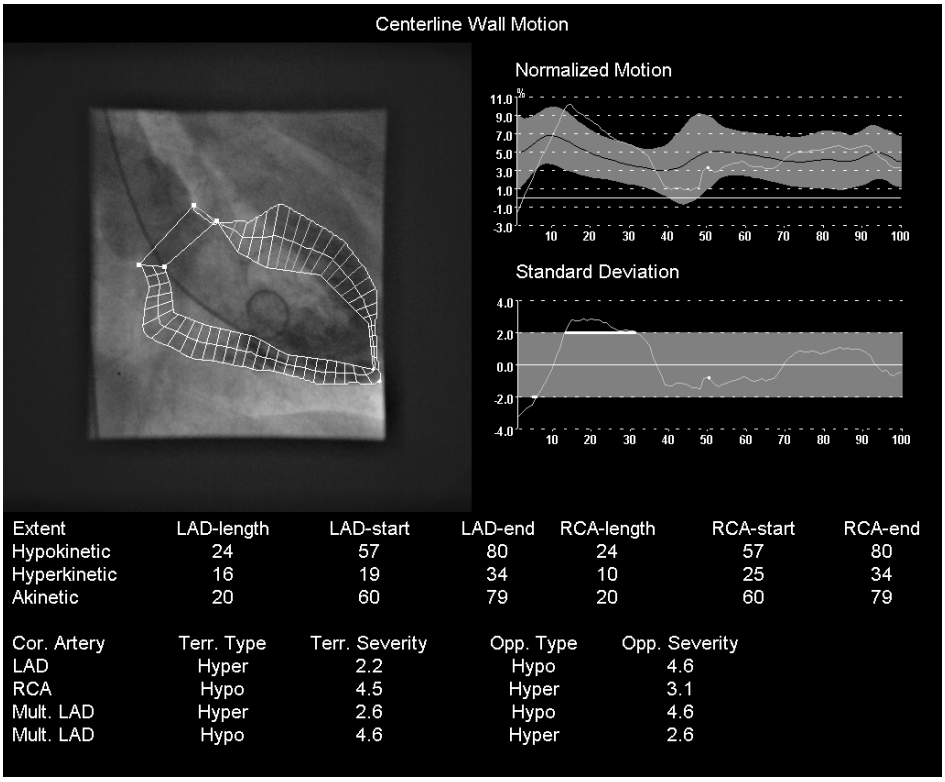
Depending on the configuration, one or more pages will be added to the first report page.

⇨ "Configuring LVA" on page 100

Siemens Service can change the default parameters which apply to a healthy population to user-defined values for the centerline and radial methods.

Centerline wall motion analysis

If configured, the **Centerline Wall Motion** analysis results are displayed on the second page of the detailed report.



Extent	LAD-length	LAD-start	LAD-end	RCA-length	RCA-start	RCA-end
Hypokinetic	24	57	80	24	57	80
Hyperkinetic	16	19	34	10	25	34
Akinetic	20	60	79	20	60	79

Cor. Artery	Terr. Type	Terr. Severity	Opp. Type	Opp. Severity
LAD	Hyper	2.2	Hypo	4.6
RCA	Hypo	4.5	Hyper	3.1
Mult. LAD	Hyper	2.6	Hypo	4.6
Mult. LAD	Hypo	4.6	Hyper	2.6

Example

This method is used to describe the displacement of specific points on the left ventricular wall between the end diastolic and end systolic phase. The calculations are based on images in standard RAO 30 projection as used for EF calculation.

A centerline is defined between the ED and ES contours, and the length of 100 equidistant lines perpendicular to the centerline is calculated. 50 of these lines are displayed. The software prevents the lines from intersecting each other.

Besides the graph with the contours and lines, a second graph is displayed in the report based on the length of the lines. The length of the lines normalized to the ED circumference is plotted as a curve against the cardiac wall position.

The vertical axis represents the length of the lines and the horizontal axis the location of the measurement points.

❑ **Normalized Motion** [%]
The white line indicates the average motion, the gray line indicates the standard deviation, the black line indicates the patient's results, and the black square indicates the apex.
The auxiliary line numbers are indicated on the horizontal axis.

Apart from the actual motion displayed by the black line, there is a gray band which indicates the wall motion parameters of the healthy population.

The data collected by the Thorax Center, Erasmus University, and Academic Hospital Dijkzigt, Rotterdam, The Netherlands, are used as default values[1]. The gray band shows the average normal parameters ± 2 standard deviations.

The third graph shows the deviation of the local wall motion parameters from the values for the healthy population. The gray band indicates the average normal parameters ±2 standard deviations, thus expressing a probability of 95%.

⇨ The centerline wall motion method is described in the medical literature (see ref. 9. in the bibliography).

[1] Siemens Service can also configure another normal population, collected by Deutsches Herzzentrum Munich, Germany.

Regional wall motion analysis

The regional wall motion analysis results are presented on a further page of the detailed report, if configured.

A graph with the ED and ES contours is displayed. It is divided into five segments, with a line superimposed through the aortic valve center. This line intersects the apical center in the mathematical center of gravity.

The points on the ventricular wall are assumed to move towards the central point at 69% of the distance between the antero-lateral edge of the aortic valve and the apex in the ED phase.

The regional wall motion analysis model describes the average shortening of the five radial segments which contribute to the ejection fraction (EF). The sixth region is the mitral valve region which is not taken into account.

To determine the segments both in the ED and the ES contour, the lower mitral valve point as well as the center of gravity are determined. The ED and ES left ventricular wall between the anterior aortic point and the lower mitral valve point is divided into five anatomical wall segments.

The radial lines separating the anterior segments are determined on the basis of the angle between the anterior aortic valve point and the apex. The radial lines separating the inferior segments are determined on the basis of the angle between the lower mitral valve point and the apex.

For the five segments of the left ventricle, the average shortening between ED and ES is calculated and indicated as a percentage. The contribution of each segment to the total shortening is displayed in the table.

- ❏ Antero-basal [%]
- ❏ Antero-lateral [%]
- ❏ Apical [%.]
- ❏ Diaphragmatic [%]
- ❏ Postero-basal [%]

The calculations are considered valid for the same standard RAO 30 projection that is used for the global ejection fraction calculation.

⇨ The method is described in the specialist literature (see ref. 8. in the bibliography).

Radial wall motion analysis

The results of the radial wall motion analysis (according to Slager) are presented on a further page of the detailed report, if configured.

On this report page the ED and ES contours are plotted with the radial lines superimposed. The left ventricle is divided into 20 slices, each slice representing a volume. The contribution of each slice to the total EF is calculated.

The radial wall motion analysis model describes the displacement of the contour points along the radial lines between the end diastolic and end systolic phases.

The motion center for the radial lines is the center of the long axis of the ES contour.

Besides the graph with the contours and radial lines, the report contains a second graph showing the length of the radial line section between the ED and ES contours. The lengths of these sections describing the wall motion are normalized to the length of the ED radius and plotted as a curve against their position along the cardiac wall.

The vertical axis represents the normalized lengths and the horizontal axis the position of the measurement points.

The ES apex point is indicated by a diamond in the graph, and the radial line numbers are indicated on the horizontal axis.

Apart from the actual motion displayed by the black line, there is a gray band which displays the wall motion parameters of the healthy population. The gray band indicates the healthy average value ±2 standard deviations.

The data collected by the Deutsches Herzzentrum Munich, Germany, are used as default values.

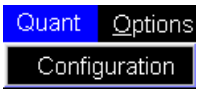
The third graph shows the magnitude of the local wall motion parameters compared with the values for the healthy population. The gray band indicates the average normal parameters ±2 standard deviations, thus expressing a probability of 95%.

⇨ The method is described in the specialist literature (see ref. 10. in the bibliography).

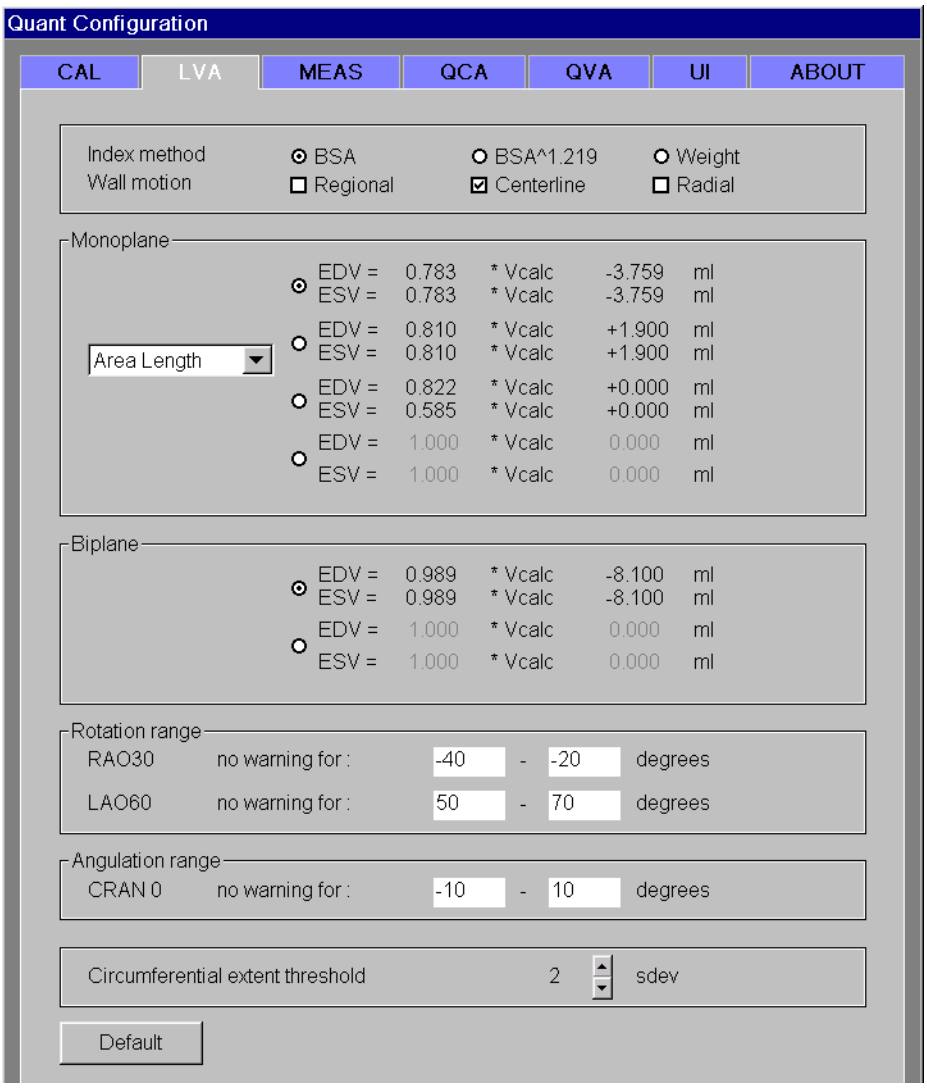
Configuring LVA

You can and must define a few settings for ventricular analysis:

At the system console (only)



- Select **Quant > Configuration** from the menu.
  – The **Quant Configuration** window is displayed.
- Click the **LVA** or **UI** subtask card into the foreground.

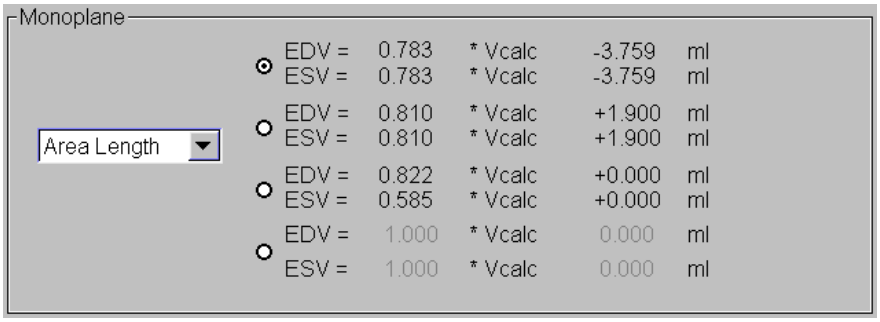


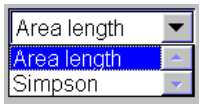
UI subtask card ⇨ Chapter **Calibration**, “Configuring the calibration”

Analysis method

- Set the required **index method** on the top of the **LVA** subtask card and set which **wall motion** analyses you want to perform.

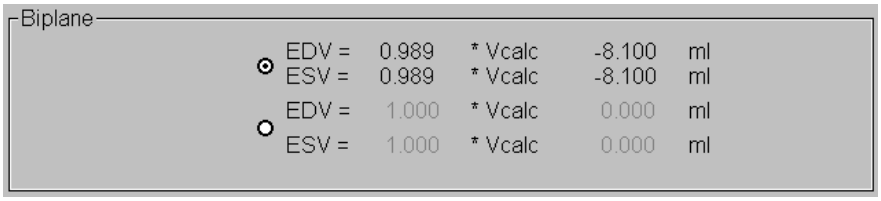
Settings for single plane


Monoplane
Area Length
EDV = 0.783 * Vcalc -3.759 ml
ESV = 0.783 * Vcalc -3.759 ml
EDV = 0.810 * Vcalc +1.900 ml
ESV = 0.810 * Vcalc +1.900 ml
EDV = 0.822 * Vcalc +0.000 ml
ESV = 0.585 * Vcalc +0.000 ml
EDV = 1.000 * Vcalc 0.000 ml
ESV = 1.000 * Vcalc 0.000 ml



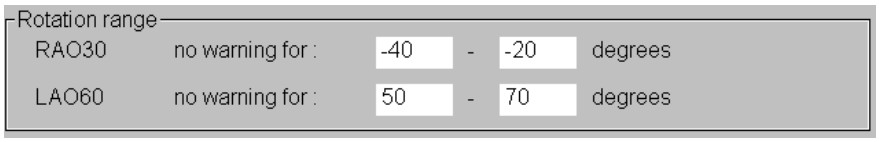
- In the **Monoplane** area on the **LVA** subtask card, set which method and volumes you want to use for single plane LVA.

Settings for biplane



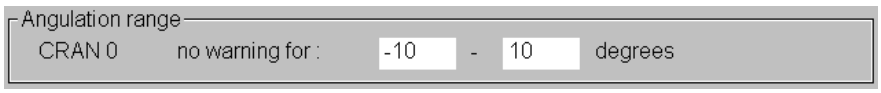
- In the **Biplane** area on the **LVA** subtask card, set which method and volumes you want to use for biplane LVA.

Permitted rotation range



- In the **Rotation range** area on the **LVA** subtask card, set for which RAO/LAO range no warning should be output.

Permitted angulation range



- In the **Angulation range** area on the **LVA** subtask card, set for which CRAN/CAUD range no warning should be output.

Threshold

- Under **Circumferential extent threshold** on the **LVA** subtask card, set which threshold (standard deviations) should be used.

Review heart rate

- On the **UI** subtask card, enter the range in which you should be able to set the **heart rate** .

Further parameters on the **UI** subtask card

⇨ Chapter **Calibration**, "Configuring the calibration"

Closing the window

⇨ Chapter **General**, "Closing default settings"

Bibliography on LVA

LV ejection fraction (EF)

1. Sandler, H. and Dodge, H.T
   The use of single plane angiocardiograms for the calculation of left ventricular volume in man.
   American Heart Journal, 75, (3), 1968, p. 325-334.
2. Kennedy, J.W., Trenholme, S.E. and Kasser, I.S.
   Left ventricular volume and mass from single-plane cineangiocardiograms. A comparison of anteroposterior and right anterior oblique methods.
   American Heart Journal, 1970, p. 348.
3. Folland, E.D. and Parisi, A.F.
   Ventricular volume and function, in: Textbook of twodimensional echocardiography
   Thalano, J.V. and Gardin, J.M. (eds), Grune & Stratton (New York), 1983, p. 165.
4. Dodge, H.T., Sandler H. et al.
   The use of single plane angiocardiograms for the calculation of left ventricular volume in man.
   Am.Heart, 1960, vol. 60.
5. Reiber, J.H.C., Viddeleer, A.R., Koning, G. et al.
   Left ventricular regression equations from single plane cine and digital X-ray ventriculograms revisited
   Int. Journal of Cardiac Imaging; 12; 1996 p. 69-78.
6. Lange, P.E., Onnasch, et al.
   Angiocardiographic left ventricular volume determination. Accuracy as determined from human casts and clinical application.
   Eur. J. Cardiology, 1978, vol. 8
7. Wynne J., Green, L., Mann T. et al.
   Estimation of left ventricular volumes in man from cine angiograms filmed in oblique projections
   Am. J. cardiol. 1978 41, p. 726-732.

Regional wall motion

Centerline wall motion

Radial wall motion

Wall load

8. Wong, W.H., Kirkeeide, R.L. and Gould K. Lance.
Computer applications in angiography. "Cardiac Imaging and Image Processing," Collins, S.M. and Skorton, D.J. (Eds.), McGraw-Hill, 1986.

9. Sheehan, F.H.
Advantages and applications of the certerline method for characterizing regional ventricular function. Circulation, 74 (2), 1986, p. 293-305.

10. Ingels NB, Daughters GT, Stinson EB, Alderman EL
Evaluation of methods for quantitating left ventricular segmental wall motion in man using myocardial markers as a standard. Circulation 61(5), p. 966-972.

11. Brower, Meester, Hugenholtz
Quantification of ventricular performance, Cathetization and cardiovascular diagnosis, 1975, 1, p. 133-155

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Accessories and Auxiliary Devices

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Equipment with accessories

Depending on the system type and configuration, the accessories described in the following chapters either form part of the standard equipment supplied or can be purchased optionally.

⇨ See current accessory catalog.

Other products/ components

⇨ For operation, technical description, models, and technical data, please see the documentation supplied by the manufacturer.

Handling accessory parts

Please handle accessory parts *carefully*. *Prevent* accessory parts from dropping down.

If a part has fallen down, then immediately *check* the part for damage. You should previously inspect in particular those accessory parts which you push underneath the patient.

Cleaning

Special cleaning instructions apply to some accessory parts.

⇨ You will find general information in part **Safety (Volume 1)**.

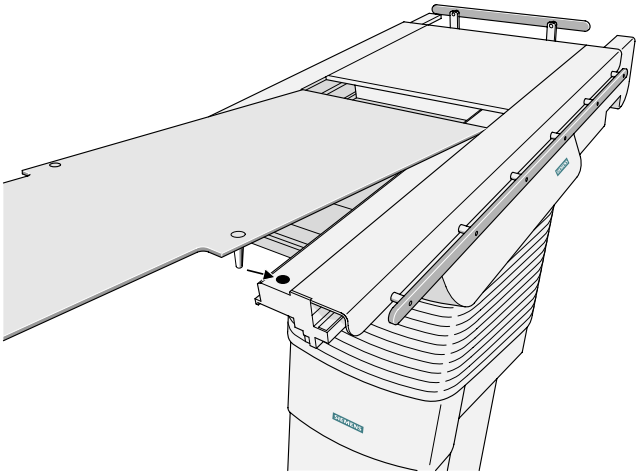
Accessories for the Patient Table (not in Artis dMP)

Tabletops

Depending on the system type and configuration, the tabletop can be changed without tools or cannot be changed (OR version).

⇨ Part **System Overview / Operating Elements**, Chapter **Equipment in the Examination Room**, "Floor-mounted patient table", "Tabletops".

Changing the tabletop



Removing the tabletop

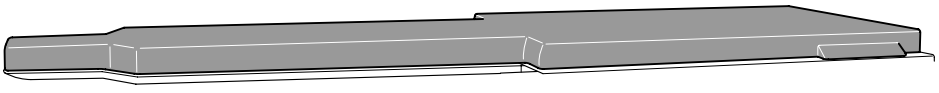
◆ Lift the tabletop at the head end and pull it off toward the front side.

Mounting the tabletop

◆ Position the tabletop at an angle so that its end is anchored in the frame and both bolts lock into the holes of the holder.

◆ Then lower the tabletop and slide it to the end position.

Mattresses



Use Mattresses are used for positioning the patient.

Although the mattress is water-proof, blood, or colored disinfectants may leave stains that cannot be removed.

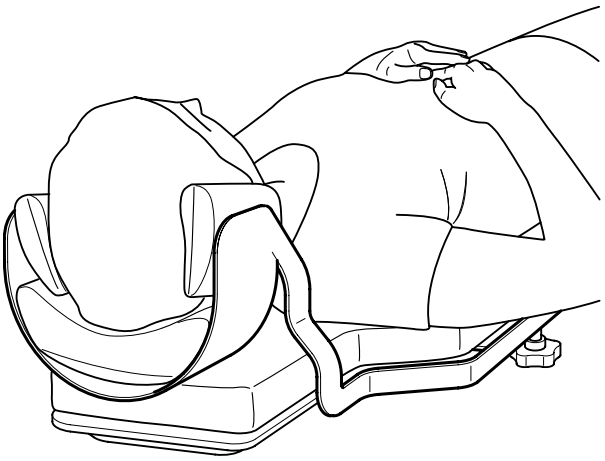
Covering the mattress

We recommend covering the mattress with a protective plastic sheet for hygiene reasons.

Cleaning the mattress

- Clean with a weak soap solution and a soft brush.
- Rinse well and dry! Do not store when wet!

Head support with cushion set

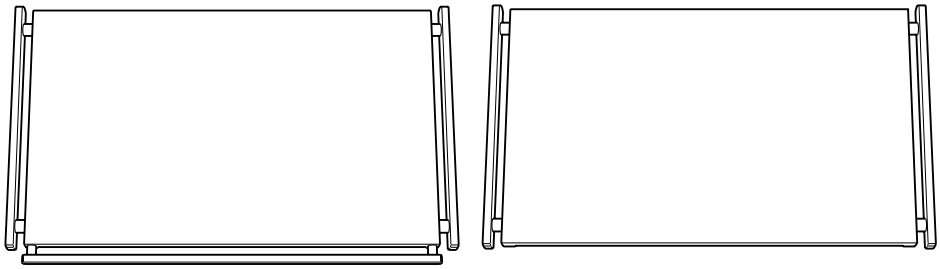


Use The head support and the cushions are used to support the head during head examinations and to minimize motion artefacts.

- Slide it over the tabletop and fix it with two knobs.
- Place the cushions for comfort and reduced head motion.

The head support can be used with the thin mattress only.

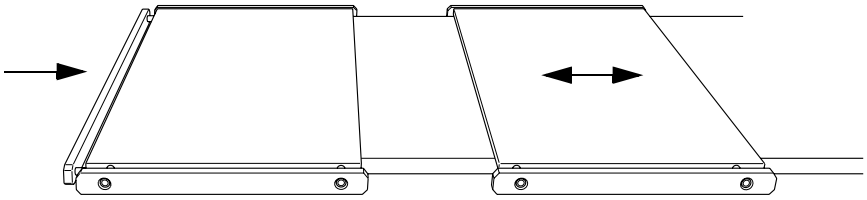
Supports with accessory rails



Use You can push two supports onto the tabletop. These are provided with accessory rails and can be moved.

Max. additional load 40 kg; reduced accordingly for a long lever

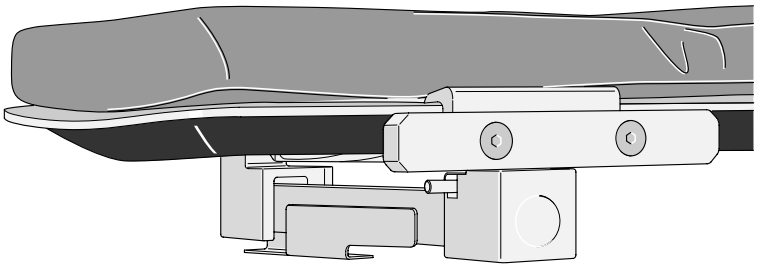
Mounting the supports



- First push the support without the head rail from the head end onto the tabletop.
- Then push the support with the head rail from the head end onto the tabletop.

During unit movements with tilted table collisions with the head rail of the support may occur.

Head-end holder



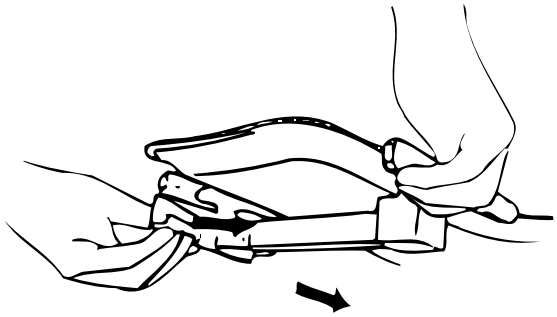
Use For attaching head and shoulder supports and anesthesia drapes to the narrow tabletop

To attach standard rail-mounted Siemens accessories (anesthesia drapes, shoulder, head or arm supports), you can attach a holder with accessory rails on both sides at the head end of the narrow patient table.

The head-end holder can only be attached to the narrow tabletop.

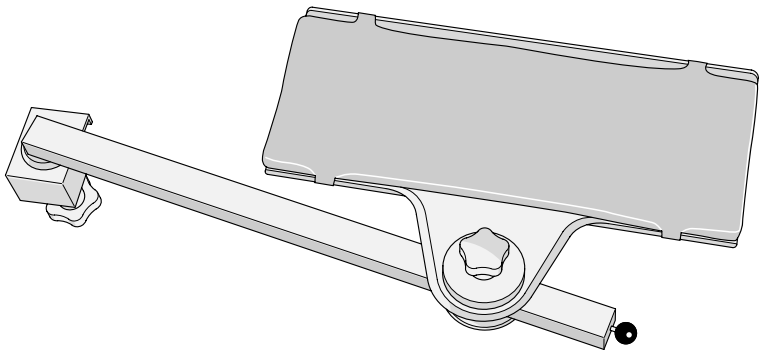
Attaching the head-end holder

- Attach the head-end holder to the head end of the tabletop.



- Turn the lever (on the underside of the holder) upward.
  – The clamping mechanism is released.
- Slide the holder clamp rails over the tabletop.
- Turn the lever downward.
  – The clamping mechanism locks.

Articulated arm support



Use For comfortable positioning of the patient.

Not radiolucent.
(Not suitable for angiography of the arm!)
Not suitable for use in the OR!

The articulated arm support attaches to the left or right accessory rail of the patient table.

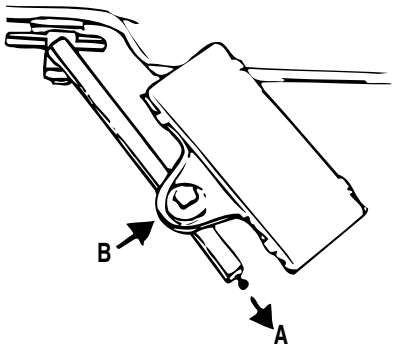
The arm support includes a cushion that can be wiped clean for the patient's comfort. The arm support is attached to a stabilizer and can be rotated/adjusted in height and length.

Attach the arm support to the patient table only after the patient has been positioned.
Remove the arm support from the patient table before the patient leaves the table!

Max. load approx. 25 kg

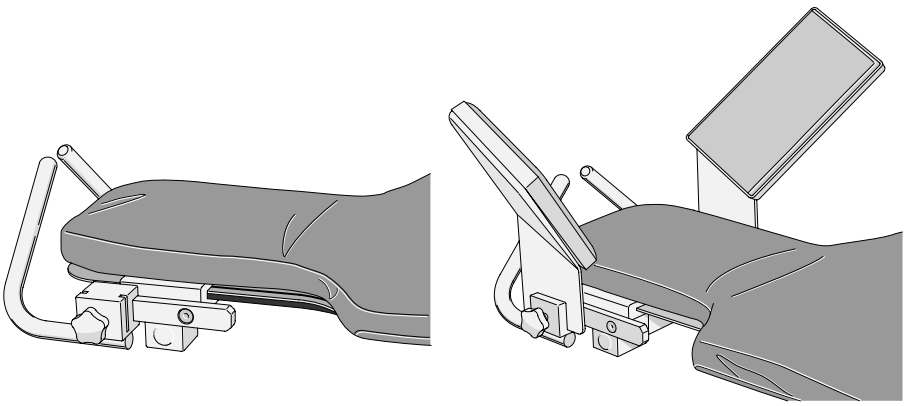
Attaching the articulated arm support

- Position the articulated arm support against one of the lateral rails or against the head-end holder.



- Slide on the mounting block and secure it with the locking knob.
- Lift up the arm support until it latches into position.
- To lower the arm support: Pull knob (A).
- To adapt the arm support to the position of the patient's arm, release locking knob (B).

Handgrips with supports



Use For cardiac exams, the arms are supported in a special position above the head to permit the flat detector to move as close to the object as possible.

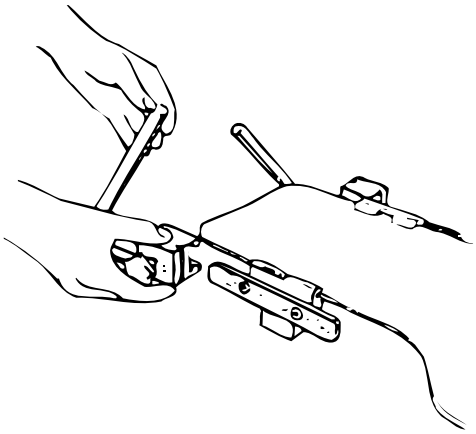
This positioning accessory allows the patient to hold on to the handgrips. The arms rest comfortably on the supports.

The handgrips of stainless steel and the radiolucent supports are screwed to the accessory rails of the head-end holder.

The handgrips can be attached only to narrow tabletops in combination with the head-end holder.

Attaching the handgrips

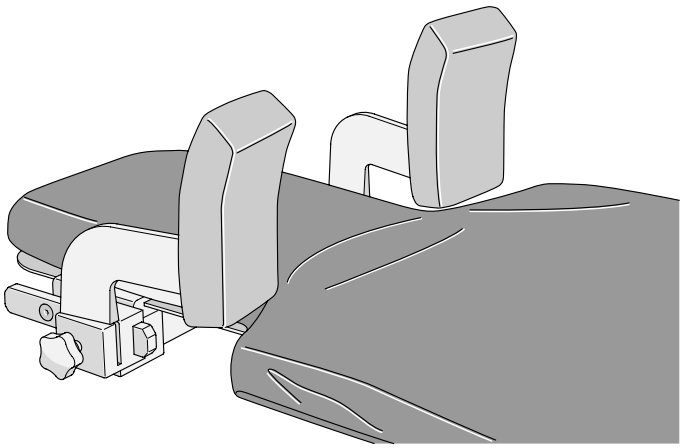
- Slide the mounting block onto the rails.
- Secure with the locking knob.



Attaching the supports

- Insert the supports into the slots of the mounting blocks on the handgrips.

Shoulder supports



Use Shoulder supports are required during exercise ECG's or for patient Trendelenburg positions of approx. 10° and above. They prevent the patient from sliding down or off the patient table.

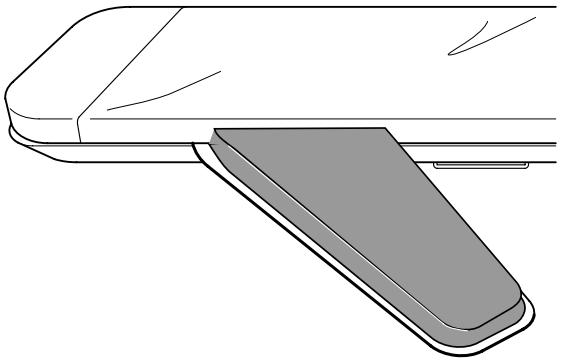
The padded shoulder supports are made from synthetic material that can be wiped clean and are attached to steel brackets which attach to the head-end holder.

The shoulder supports can be attached only to narrow tabletops in combination with the head-end holder.

Attaching the shoulder supports

- The shoulder supports can be slid onto the rails of the head-end holder.

Arm support



Use For metal-free positioning of the patient's arm for DSA of the arm and hand.

The unilateral arm support has proven valuable for the Sones technique in cardiology and for angiography of the arm.

It is made of shadow-free, radiolucent carbon-fiber material and is easy to clean.

The 1 m long arm support is positioned under the mattress at shoulder level on the right or left and held in place by the patient's weight.

Max. load max. 5 kg

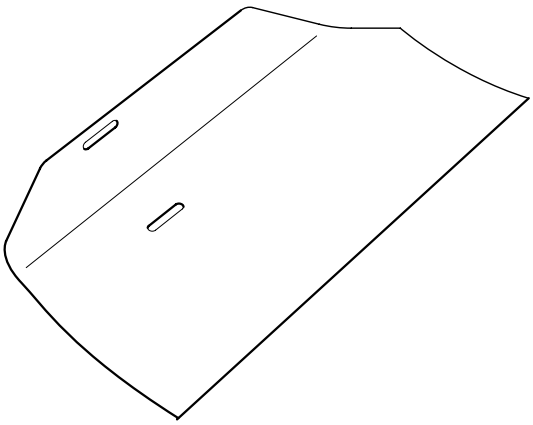
Aluminium equivalent 0,40 mm Al +/- 15% at100 kV/HVL 2,7 mm Al

0,49 mm Al +/- 15% at100 kV/HVL 3,7 mm Al

Attaching the arm support

- Insert the arm support under the mattress at the level of the patient's shoulder.

Arm holders



Use For comfortable positioning of the arms alongside the patient's body.

The two arm holders allow the patient's arms to be comfortably positioned along the patient's body, especially on narrow tables.

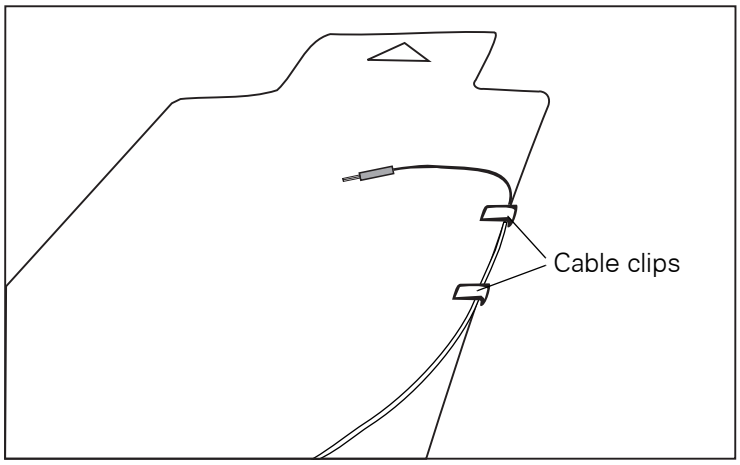
The arm holders are slipped under the patient's arms on both sides and held in place by the patient's weight.

The patient's arms can be immobilized with commercially available straps.

Attaching the arm holders

- Insert the arm holders under the mattress at the patient's arm level from the right-hand or left-hand side.

Cable clips

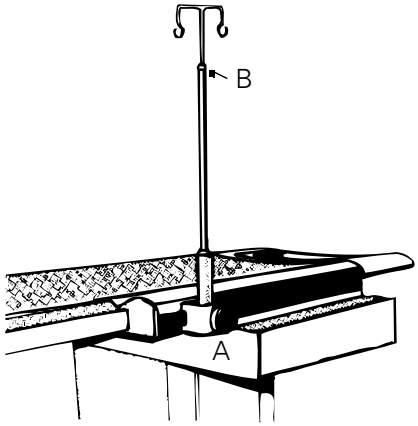


Use For fastening ECG cables.

Attaching the cable clips

- Place the ECG cable in the clip and push the clip on from the head end of the tabletop. Take care that the clips are guided in the groove on the underside of the tabletop.

Infusion bottle holder

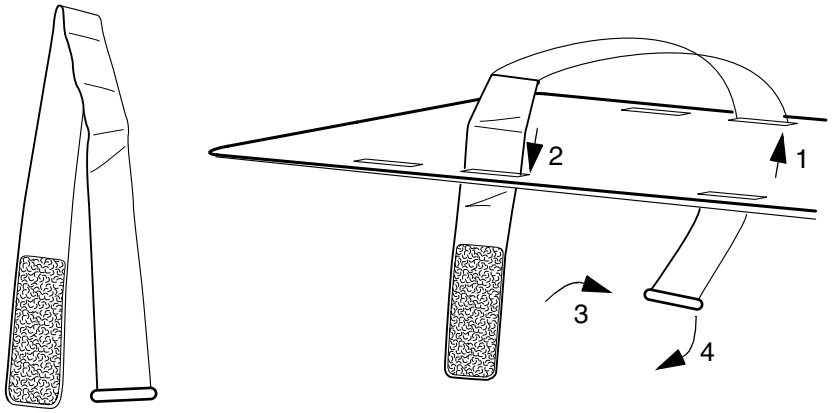


Use For suspending infusion bottles.

Attaching the infusion bottle holder

- Attach the infusion bottle holder to the table rail.
- Secure the infusion bottle holder with locking knob (A).
- Adjust the height of the infusion bottle holder with locking knob (B).

Immobilizing straps



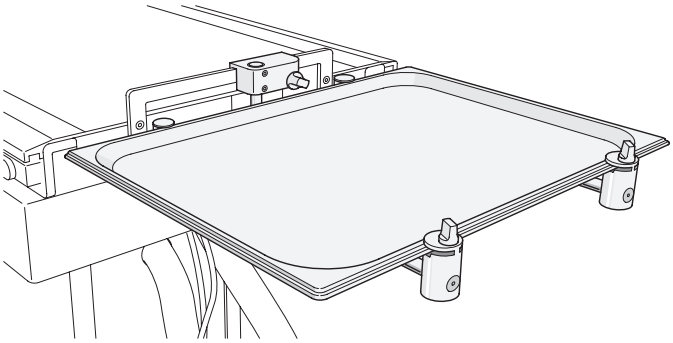
Immobilizing strap (left), attaching the strap (right))

Use Two straps with Velcro fasteners are available for immobilizing the patient. You can attach them to the tabletop.

Attaching the immobilizing straps

- Pull the strap through the holes in the tabletop.
- Pull the strap through the loop at the end and fold it back, draw it tight if necessary, and fasten it with the Velcro strap.

Catheter tray, footside

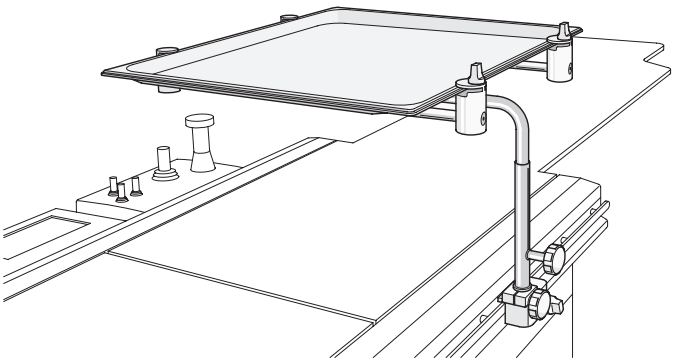


The catheter tray can be attached to all Artis systems except for Artis dMP and Artis MP.

Load capacity: 5 kg

- Attach it to the accessory rail and fix it with the knobs.

Instrument tray



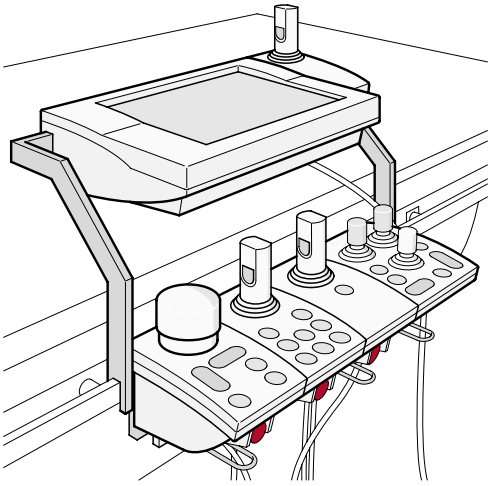
The instrument tray can be attached to both sides of the table of all Artis systems.

It can be turned and adjusted in height for your convenience.

Load capacity: 2 kg

- Attach it to the accessory rail and fix it with the knobs.

Stackable accessory rail

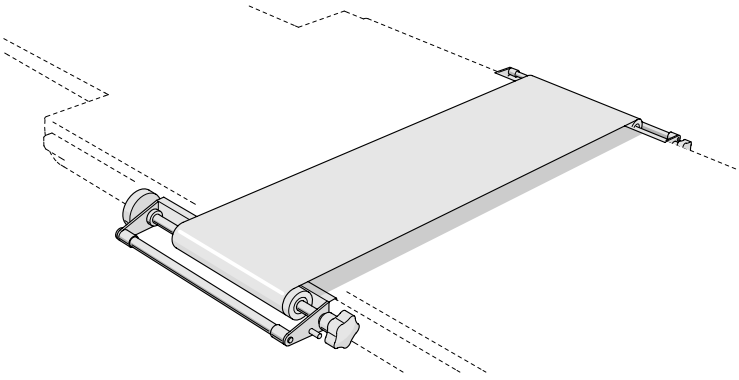


The stackable accessory rail holds the touchscreen control or other control consoles.

Load capacity: 6.2 kg

- Attach it to the accessory rail and fix it with the knobs.

Abdominal compression band



Use The compression band helps to secure patients quickly on the tabletop and also serves to even out the thickness of body parts.

The compression band has a washable strap made of radiolucent fabric.

It is attached to the accessory rails on both sides of the patient tabletop.

Attaching the compression band

◆ Attach the compression band to the table rails.

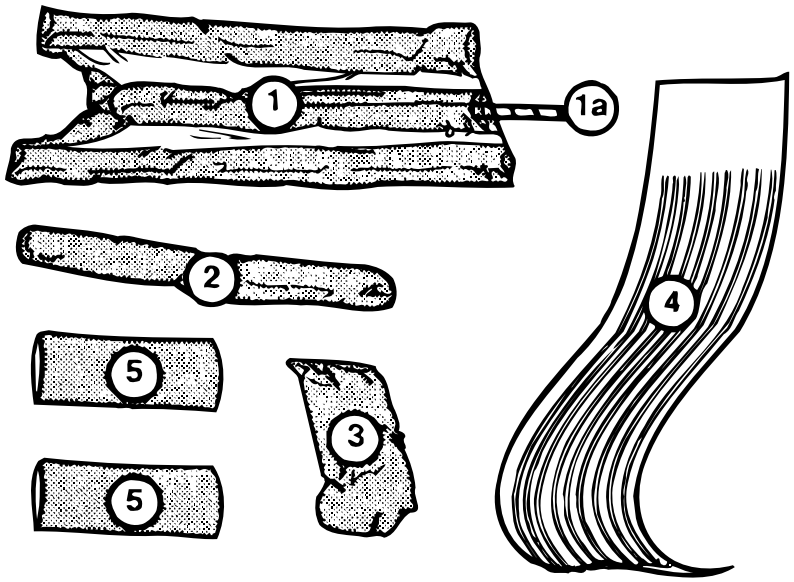
Adjusting the tension

◆ Press the locking lever of the compression band outwards several times.

Releasing the tension

◆ Press the locking lever of the compression band inward.

Positioning set with transparency compensation



(1) Transparency compensation (with rice flour filling)

(1a) Insertable lead ruler

(2) Long bag (with rice flour filling)

(3) Foot bag (with rice flour filling))

(4) Immobilization strap (with Velcro fastener)

(5) 2 foam cushions

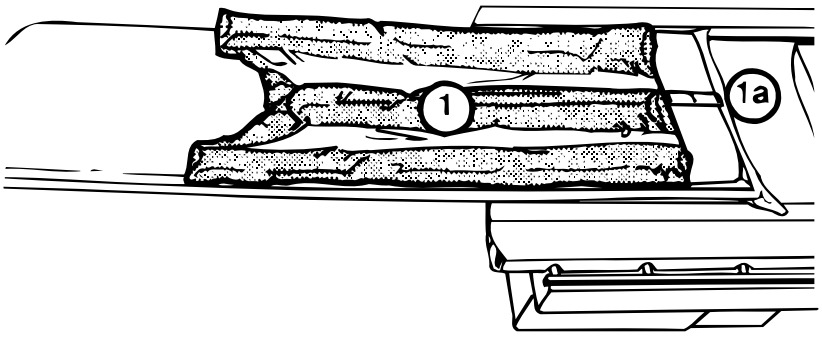
Use As transparency compensation for peripheral examinations.

The seams of the transparency compensation are not water-proof.
Therefore, the manufacturer recommends covering the transparency compensation with a plastic sheet (or plastic bag) made of a plastic material approved for medical use to protect it from liquids.

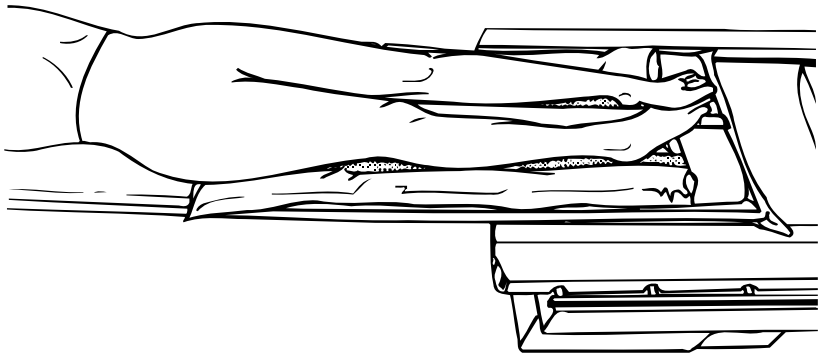
Attaching the positioning set

When applying or removing the transparency compensation, always remove the lead ruler first.

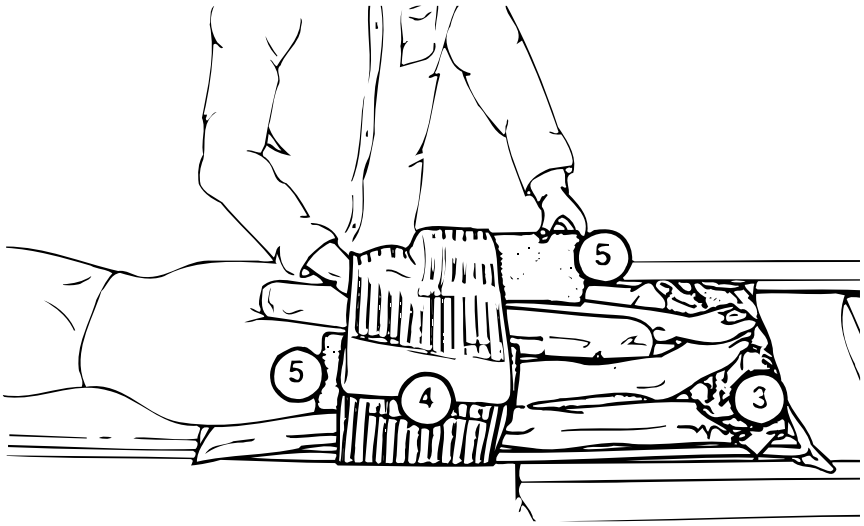
- Place the transparency compensation (1) on the tabletop.
- Insert the lead ruler (1a) if required.
- Cover the transparency compensation with a water-proof sheet for hygiene reasons.



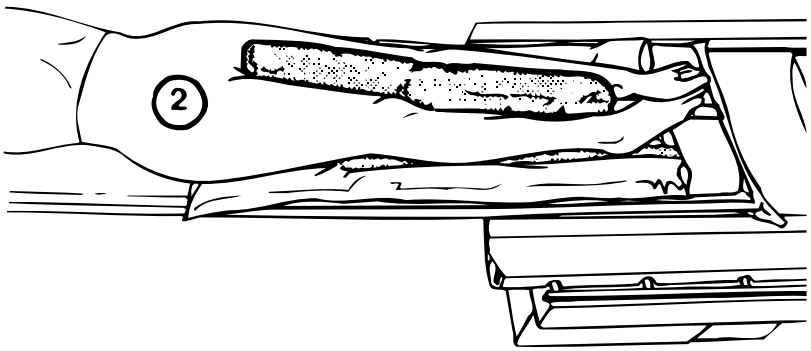
- Position the patient.
- Place the patient's legs as close to each other as possible and the knees right next to each other.



- Place the foot bag (3) under the feet.
- Wrap the immobilization strap (4) around the tabletop or under the positioning mattress.
- Close the Velcro of the immobilization strap.
- Insert the 2 foam cushions (5) to the side of the patient's knees.

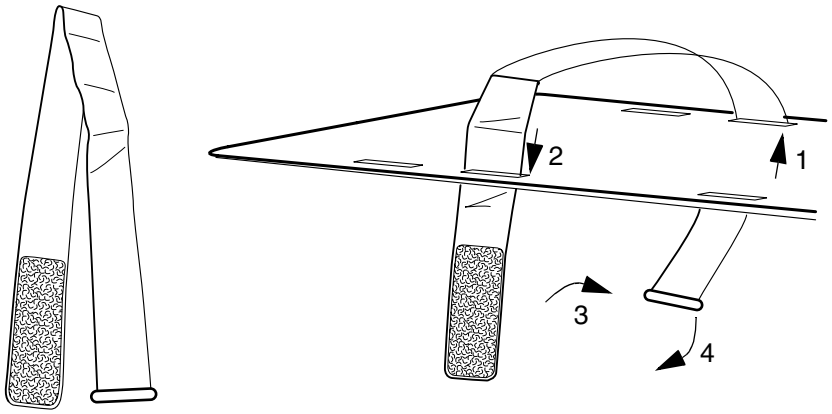


- Place the long bag (2) between the patient's legs after immobilizing her or him with the immobilization strap.
- Ensure that the patient's knees are still close together.



Immobilizing straps

Use Two straps with Velcro fasteners are available for immobilizing the patient. You can attach them to the tabletop.



Immobilizing strap (left), attaching the strap (right)

Using the immobilizing straps

- Pull the strap through the holes in the tabletop.
- Pull the strap through the loop at the end and fold it back, draw it tight if necessary, and fasten it with the Velcro strap.

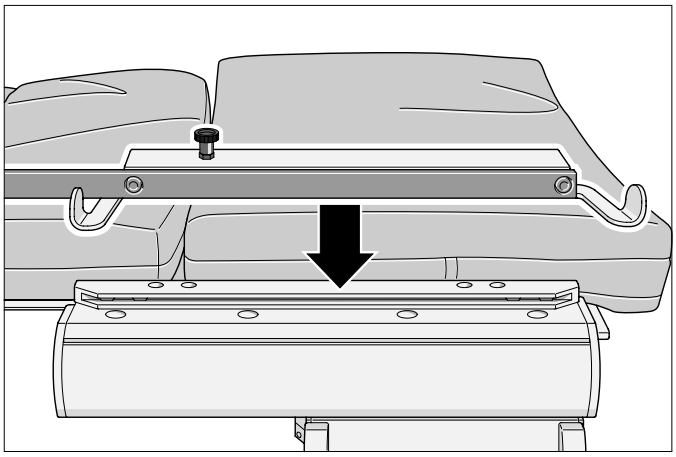
Caution

The immobilization straps and hand grips are not suitable for holding the patient when the table is tilted.

Danger of slipping off!

- Use recommended positioning accessories when tilting the table (e.g. footboard or shoulder belt).

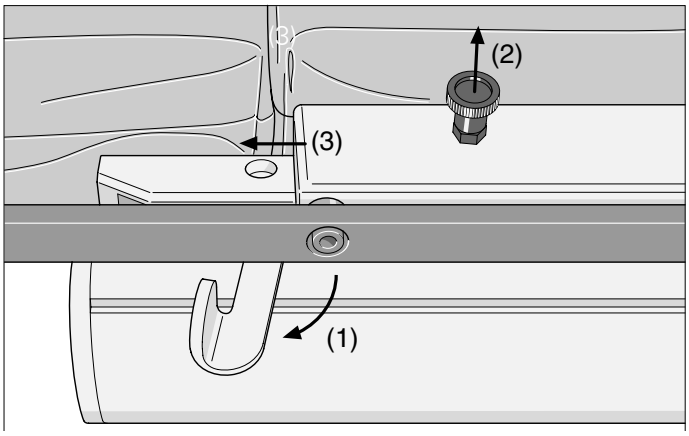
Holder with accessory rails



Use For attaching operating consoles or other accessories

Attaching the accessory rail

- Set the tabletop horizontal.

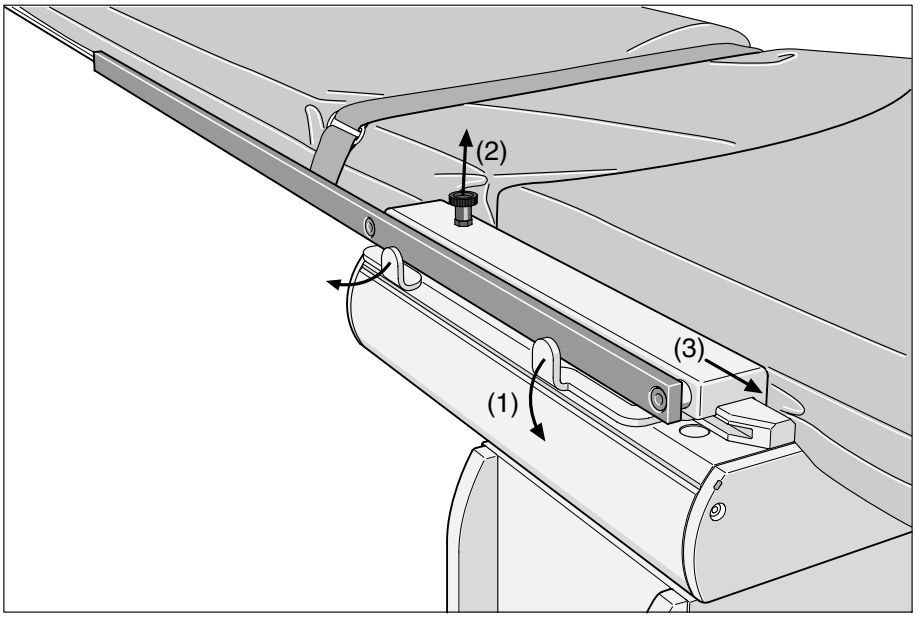


- Move the two levers (1) outward, lift the locking bolt (2), and push the holder from the foot end into the rail of the tabletop (3) (or from the head end onto the rail of the adapter) as far as it will go.

- Release the locking bolt.
  – The locking bolt must engage into one of the holes by the action of its spring.
- Move the two levers (1) back again.
  – The mechanism must engage with little effort.
- Check that the accessory rail is firm by pulling and pushing it.

Removing the accessory rail

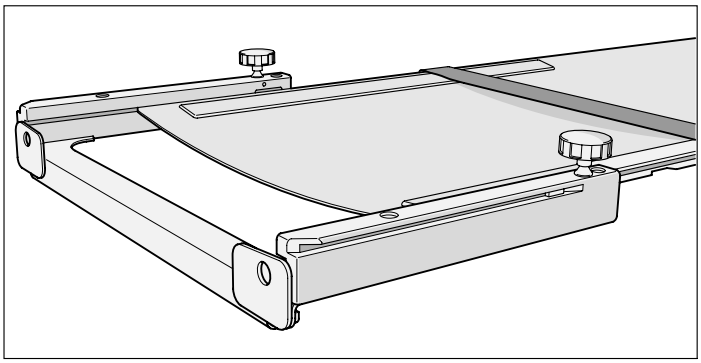
- Set the tabletop horizontal.



To remove the rail, proceed in the reverse order:

- Move the two levers (1) outward, lift the locking bolt (2), and pull the holder out toward the foot end (3).

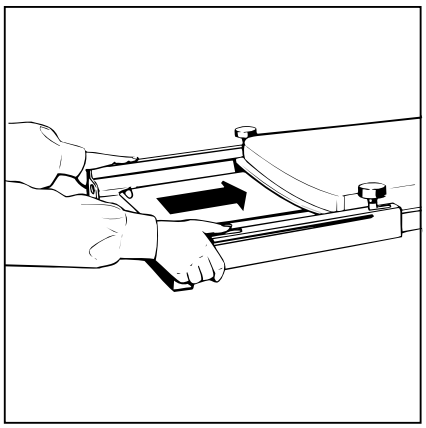
Adapter with rails



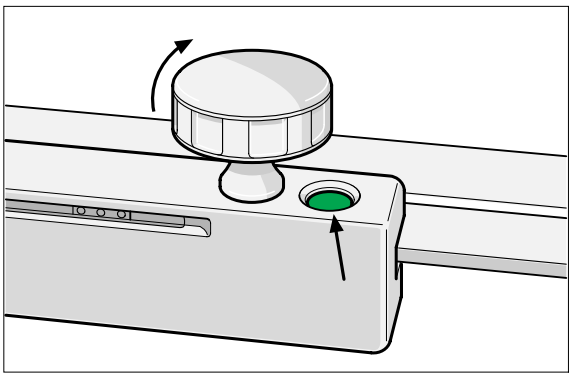
Use For attaching accessories at the head end of the tabletop

Attaching the adapter

- Set the tabletop horizontal.



- Position the adapter against the horizontally positioned tabletop as shown and push the adapter in as far as it will go (flush with the tabletop).



◆ Turn the two hand screws clockwise.

Make sure the mechanism engages in the notches of the tabletop (by moving the adapter back and forth slightly).

◆ Turn until the green knob of the tension element is flush with the adapter.

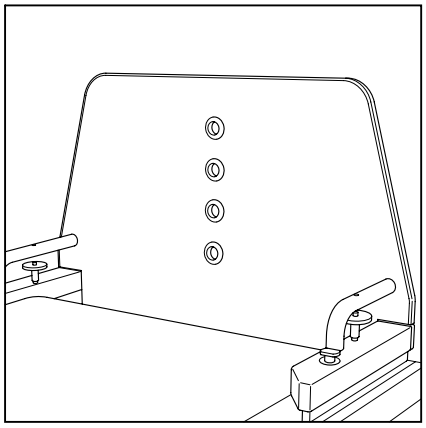
Removing the adapter

◆ Set the tabletop horizontal.

To remove the adapter, proceed in the reverse order:

◆ Turn the two hand screws counterclockwise until the adapter can be pushed out toward the head end.

Footboard



Use Positioning aid for standing or sitting patients and for additional use of the foot holder for acquisitions in the Trendelenburg position

You can also attach the footboard to the head end of the tabletop if the patient has to be positioned turned round.

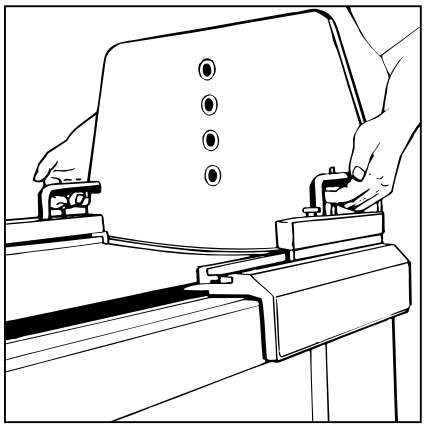
To permit the central beam to reach the feet for phlebography, the footboard must be moved toward the head.

- For this you need to remove the mattress part.

Attaching the footboard

- Set the tabletop horizontal.

Attaching the footboard to the foot end

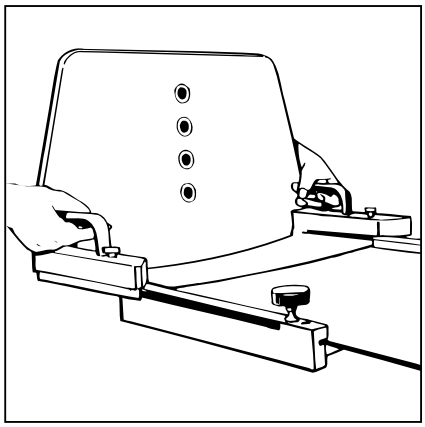


- Lift up the two locking bolts and push the footboard into the rail of the tabletop from the foot end as far as it will go.
- Release the locking bolts.
  – The red mark on the locking bolts must line up precisely with the clamps.
- Make sure that the footboard is attached firmly by pulling and pushing it.

Attaching the footboard to the head end

- Mount the adapter.

⇨ "Adapter with rails" on page 28



- Position the footboard against the adapter, lift the locking bolts and push the footboard into the adapter as far as it will go.
- Release the locking bolts.
  – The red mark on the locking bolts must line up precisely with the clamps.

Checking firm attachment

Caution

Footboard not firmly attached

Danger of slipping off!

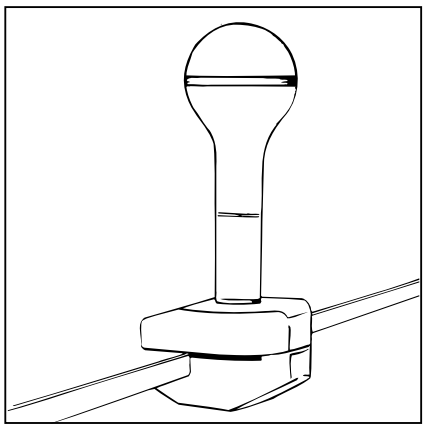
- Make sure that the footboard is attached firmly by pulling and pushing it and remove only when table is horizontal.

- Please ensure that patients sit or stand on the footboard only after you have checked that both bolts are locked in position.
- If you want to tilt the tabletop from the horizontal into the Trendelenburg position, it is essential for angles of 15° or more that you secure the patient with the foot holder and/or the shoulder belt.
- Ensure that patients standing on the footboard hold both handgrips firmly.
- Use the belt compression system as an additional aid for immobilizing weak or very unstable patients.

Removing the footboard

- Set the tabletop horizontal.
- Lift the two locking bolts and pull the footboard out.

Handgrips



Use The detachable handgrips offer the patient a secure grip, thus allowing him/her to feel more secure.

Attaching the handgrip

- Attach the handgrip so that the tabletop is located in the guide slot of the handgrip.
- Tighten the handgrip.

Caution

The immobilization straps and hand grips are not suitable for holding the patient when the table is tilted.

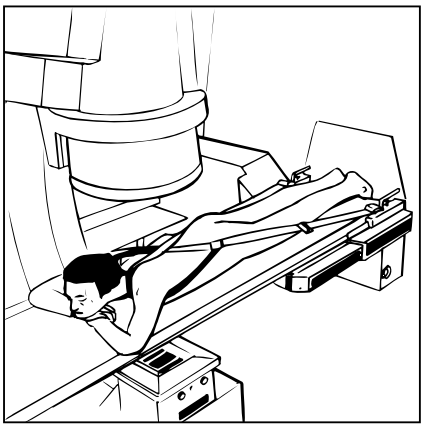
Danger of slipping off!

- Use recommended positioning accessories when tilting the table (e.g. foot-board or shoulder belt).

Shoulder belt

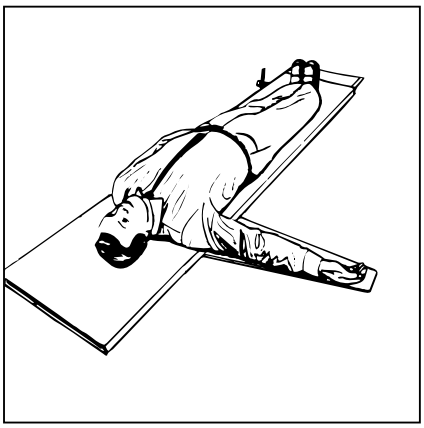
Use For immobilizing the patient during examinations or interventional procedures performed in extreme Trendelenburg positions.

Using the shoulder belt



- Position the patient prone.
- Hook the belt in the guide hooks.

Arm support

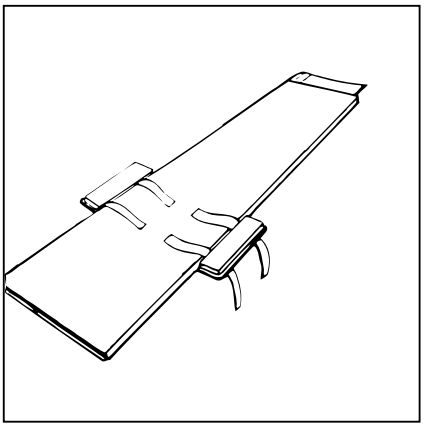


Use The arm support is used to comfortably position the patient's arm during injections or infusions. It contains no interfering metal parts.

Using the arm support

- Insert the end of the arm support between the tabletop and the mattress.

Tabletop extension



Use For comfortably supporting the patient's arms on both sides.

Using the tabletop extension

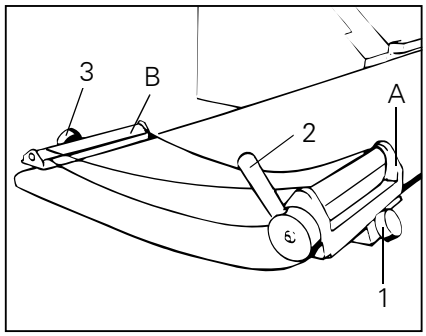
- Insert the tabletop extension between the tabletop and the mattress.
- Fasten the lateral arm pads to the tabletop extension using the Velcro straps.

Compression unit

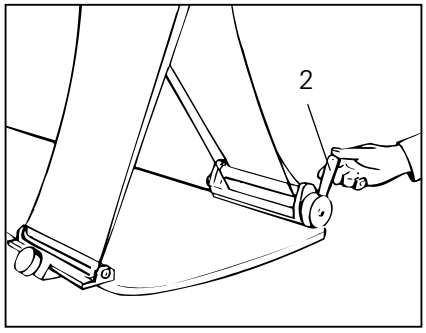
Use You can use the compression unit both for compressing disturbing tissue layers and for immobilizing restless patients.

AL equivalent ≤ 0.8 mm

Attaching the compression unit



- Insert the tensioning part (A) of the compression unit into the tabletop.
- Secure the tensioning part with the hand screw (1).
- Release the belt lock by pulling the lever (2) toward you.
  – You can now unroll the compression belt.
- Insert the guide part (B) into the opposite side of the tabletop and secure it with the hand screw (3).



- Pump the lever (2) to tighten the compression belt.
- Pull the lever (2) toward you to release the compression belt.

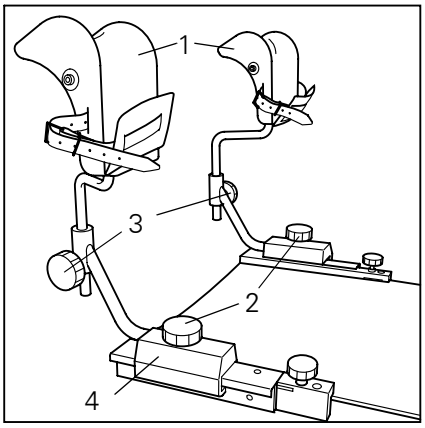
Stirrups

Use Positioning aid for immobilizing the lower extremities

Attaching the stirrups to the table

- Set the tabletop horizontal.
- Mount the adapter.

⇨ "Adapter with rails" on page 28



- Loosen both hand screws (2).
- Insert the base (4) into the adapter.
- Tighten the hand screws (2).
- Insert both leg supports (1) into the relevant holders at the hand screw (3).
- Tighten the hand screws (3).

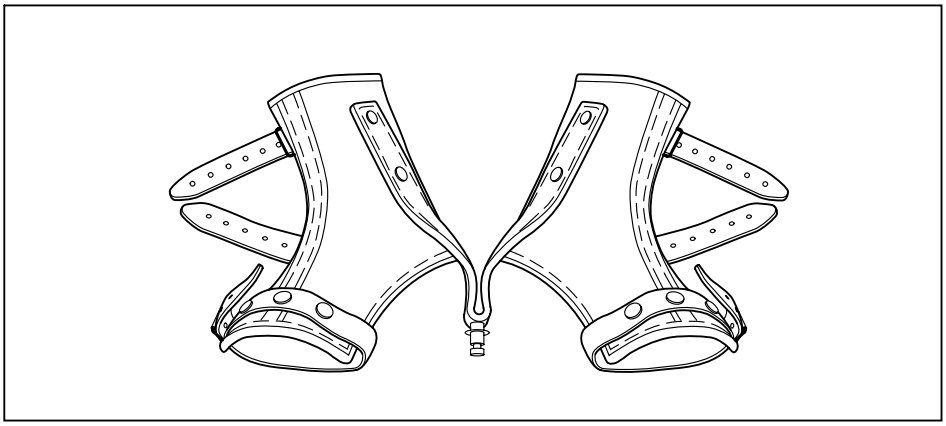
Attaching the stirrups to the patient

- Position the patient on the tabletop.
- Push the stirrups into the examination position.
- Open the holding straps on the leg supports.
- Place the lower legs of the patient on the leg support.
- Lift the leg supports to the examination height and turn them inside or outside for the required patient leg-spread.
- Check that the leg supports and bases are firmly attached by pulling and pushing them.
- Place leather pads centrally beneath the patient's lower legs.
- Place the holding straps around the patient's lower legs.
- Tighten the holding straps.

Removing the stirrups

- Position the tabletop horizontally.
- Open the holding straps.
- Lift the legs of the patient out of the leg supports.
- Wrap the holding straps around the leg supports.
- If necessary, pull out the leg supports after loosening the hand screws (3).
- Loosen the hand screws (2).
- Pull the stirrups / bases out of the accessory rails.

Foot holder



Use

For securing the patient during examinations in the Trendelenburg position with a relaxed spinal column.

Inspection/maintenance note

Check that the foot holder is in a proper condition at regular intervals of approximately two months.

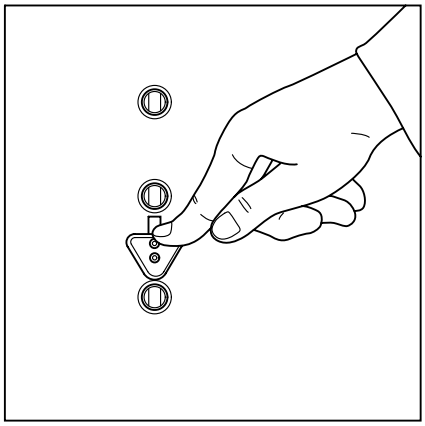
Check especially that the fastening rivets, the supporting straps and closing straps are firmly attached, that their seams are complete and that the leather is free of cracks and porous areas.

If the foot holder shows any signs of defects, take it out of service and obtain a replacement through Siemens Uptime Service.

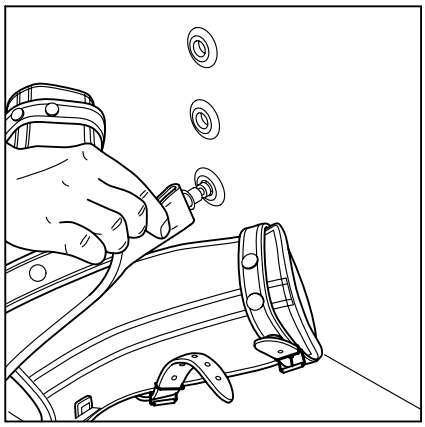
We recommend using a commercially available transparent impregnating pump spray for leather for cleaning and care.

Attaching the foot holder

- Position the tabletop horizontally.
- Attach the footboard.
- Make sure that the footboard is attached firmly by pulling and pushing it.
- Position the patient in the prone or supine position with his/her feet resting against the footboard.
- Place the foot holder closely around the patient's ankles.
- Tighten the straps.



◆ Push the triangular locking tab on the back of the footboard down and hold it firmly.



◆ Insert the metal spigot of the foot holder in the hole of the appropriate footboard that will enable the patient to lie quietly and relaxed.

❑ The patient's heels or toes should lie lightly on the tabletop.

◆ Release the locking tab.

◆ Check the locking of the foot holder by pulling on it.

Ensure without fail that the metal spigot of the foot holder is locked in the footboard.

◆ Instruct the patient to hold the handgrips firmly during this examination!

Removing the foot holder

- Position the tabletop horizontally.
- Push the triangular locking tab on the back of the footboard down and hold it firmly.
- Pull the metal spigot of the foot holder out of the hole of the footboard.
- Loosen the straps.
- Lift the patient's feet out of the foot holder.

Accessories for the primary collimator

Dose measuring device (standard in the EU)

The area dose product is measured with a dose measuring chamber during fluoroscopy and acquisition.

Its value is displayed on the system console and on the data display.

⇨ Part **Examination**, Chapter **Preparing the Examination - Fluoroscopy - Acquisition**, "Monitoring the dose"

The values are also listed separately in the examination data for each scene.

Systems with a dose measuring chamber also calculate and display the skin dose per scene and register it in the examination data.

Compensating filter

Blooming in the skull area is reduced in carotid artery angiography with the compensating filter.

Two compensating filters in bowl form are available:

❏ Compensating filter for adults

❏ Compensating filter for children

Inserting the filter

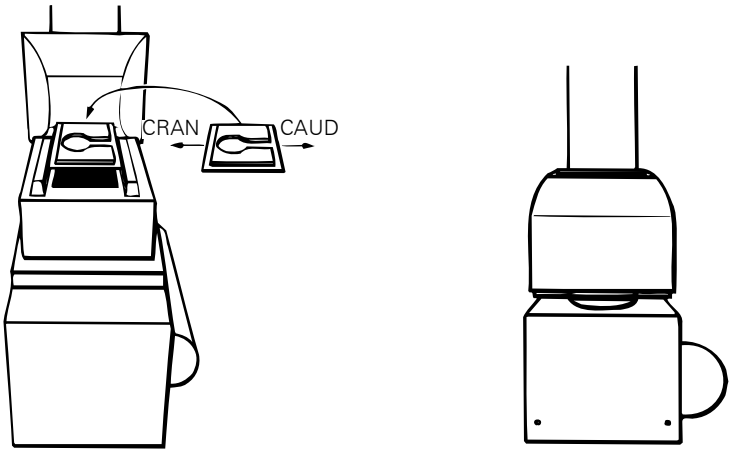
◆ Open the tube cover by pressing the buttons on both sides.

◆ Turn the compensating filter into the correct working position (that is, into the correct CRAN/CAUD position in relation to the patient).

◆ Insert the compensating filter into the lower rails of the primary collimator between the X-ray tube assembly and the dose measuring chamber.

◆ Push the compensating filter in until it snaps into place so that it is correctly centered.

If the dose measuring chamber is installed, the filter must be placed beneath it, otherwise the measurement will be falsified.



- Close the cover of the primary collimator until you hear it snap into place.
- Make sure that the cover is closed properly.

Perform unit movements only with the cover closed.

Removing the filter

- Do not forget to remove the compensating filter after the examination.

Accessories for radiation protection

Radiation protection for the lower body

Use The lower body radiation protection is provided to reduce the scattered radiation in the lower body of the examiner.

The lower body radiation protection is *not* suitable for supporting loads! This means, it cannot bear additional weight of, for instance, lead-rubber aprons. This could pull down the lower body radiation protection.

- ◆ Do not hang any objects on it.

The swiveling part of the lower body radiation protection may only be pushed onto the rail of the fixed part of the radiation protection attached to the base of the table.

The lower body radiation protection is not monitored by the collision computer.

- ◆ Avoid possible collisions while performing unit movements.
- ◆ You must swivel the radiation protection for the lower body away from the patient table in extreme LAO/cranial angulations to avoid collisions with the X-ray tube.

If several systems are installed, it might be possible to confuse removable parts of the lower body radiation protection.

- ◆ Use only those parts which belong to this system.

Technical data

- ❑ The lead equivalent value of all lead rubber parts is 0.5 mm (according to EN 61331-3:1999).
- ❑ The heat resistance is approximately 80°C.

Cleaning and disinfection

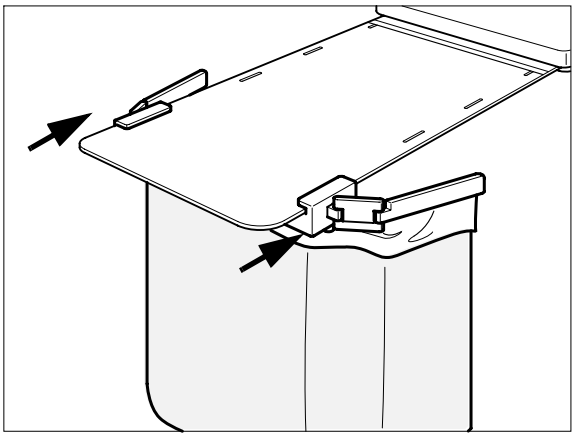
Slightly soiled lead leaves and metal parts can be cleaned with a soft cloth and lukewarm water with a household detergent.

Heavy dirt and grime should be wiped off with a linen cloth moistened with alcohol and then rinsed with clear water.

Remove blood spots best of all with cold water.
Remove contrast medium spots best of all with warm water.

Use a disinfectant commercially available for medical use to disinfect the radiation protection device.
Then wipe it off with clear water.

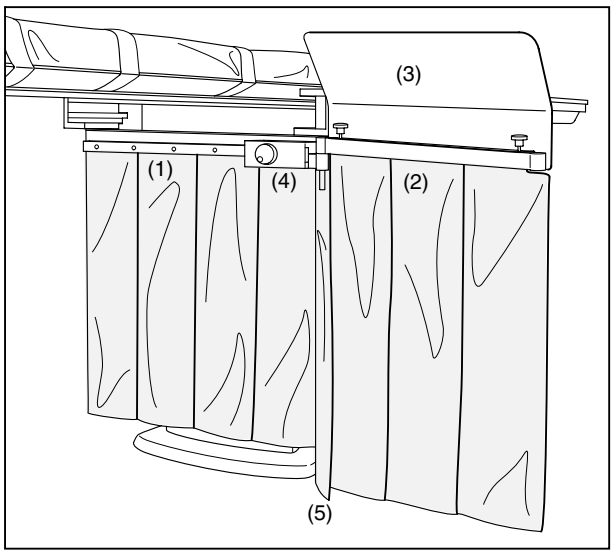
Radiation protection for attaching to the wide tabletop



Attaching

- Slide the radiation protection over the wide tabletop as shown in the image.
- Adjust the sides to your needs.

Radiation protection for systems with separate patient table



(1) Part fixed to the base of the table with a rail for relocating the moveable part

(2) Swiveling lead leaf rail

(3) Lead rubber top section

(4) Adapter for the rail for attaching the moveable part

(5) Lead rubber leaf

Attaching the lower body radiation protection

The fixed part of the lower body radiation protection with a rail (1) is permanently installed by Siemens Service on the base of the patient table.

- Attach the double articulated arm with the lower body radiation protection (2) to the metal rail (1). The position can be selected. It can be changed by loosening the thumb screw (4).
- Raise the double articulated arm before tightening the thumb screw so that the adapter is attached exactly on the metal rail.

Tighten the thumb screw securely to ensure the necessary stability.

- Hook the lead rubber leaf (5) with the handle to the outside in the adapter of the articulated arm.
- Attach the plug-on part to the fixed part of the lower body radiation protection.

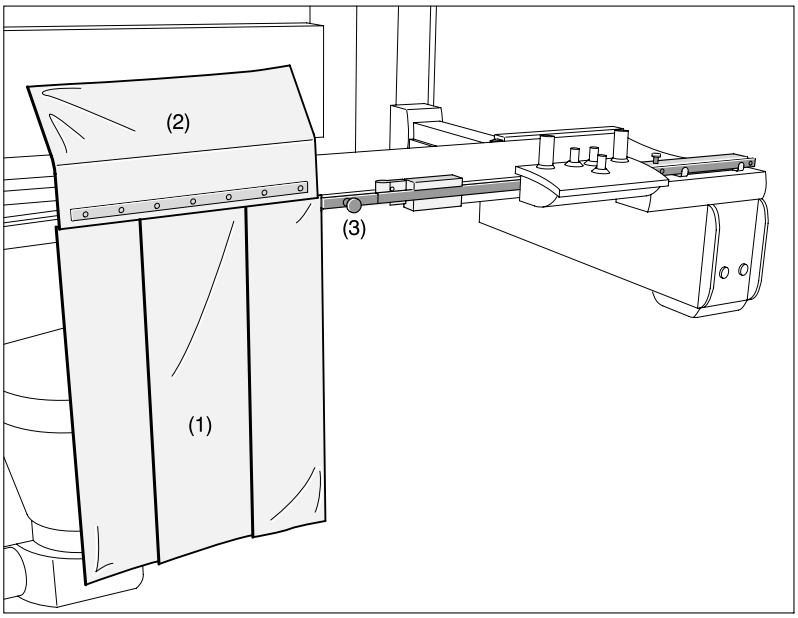
If it is not required, e.g. when repositioning the patient, it should be kept on the wall holder.

Using the lower body radiation protection

- To reposition the patient, remove the plug-on part or swing the lower body radiation protection under the patient table.
- Before starting the examination, make sure that the adapter runs parallel to the patient table and the plug-on part is plugged onto the lower body radiation protection.

The friction moment of the moveable arm can be adjusted for the situation (table with/without tilt) by Siemens Service.

Radiation protection for Artis dMP



(1) Part plugged onto the accessory rail

(2) Lead rubber top section

(3) Fixing screw

Attaching the lower body radiation protection

- Push the large part of the lower body radiation protection onto the tightened accessory rail and tighten the knurled screw (3).

Tighten the thumb screw securely to ensure the necessary stability.

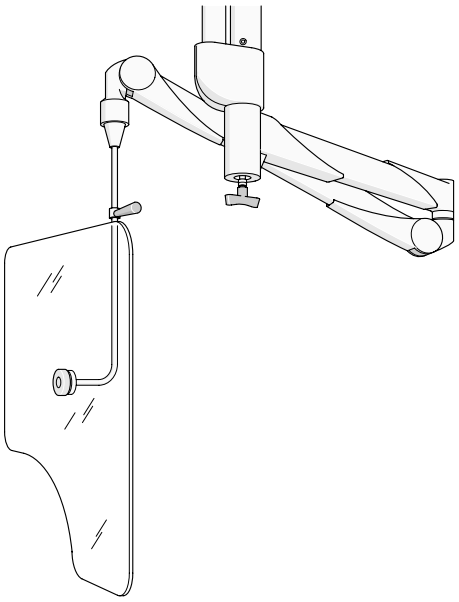
- Attach the plug-on part to the fixed part of the lower body radiation protection.

If it is not required, e.g. when repositioning the patient, it should be kept on the wall holder.

Using the lower body radiation protection

- Remove the radiation protection to position the patient.
- Before starting the examination, make sure that the plug-on part is plugged onto the lower body radiation protection.

Radiation protection for the upper body



Use

The radiation protection window is used to reduce exposure of the examiner's upper body to scattered radiation. It is especially designed to decrease the exposure of the examiner's eyes and thyroid to radiation.

The radiation protection window can be moved in any direction.

Lead equivalent

The lead equivalent value is 0.5 mm (according to EN 61331-3:1999).

Cleaning and disinfection

You can clean a slightly soiled lead glass pane with a lukewarm detergent solution and a soft cloth.

Heavy dirt and grime should be wiped off with a linen cloth moistened with alcohol and then rinsed with clear water.

Remove blood spots best of all with cold water.
Remove contrast medium spots best of all with warm water.

Use a disinfectant commercially available for medical use to disinfect the radiation protection device.
Then wipe it off with clear water.

Sterile cover

Both window designs can be provided with sterile covers; contact your Siemens sales representative.

Using the upper body radiation protection

The upper body radiation protection is *not* suitable for supporting loads! This means, it is not suitable for carrying any additional weight.
This could pull down the upper body radiation protection.

- Do not hang any objects on it.

During unit movements, especially swiveling movements, there is a risk of collisions and damage (could break off and fall down).

- Watch out for possible collisions while performing unit movements.

Positioning

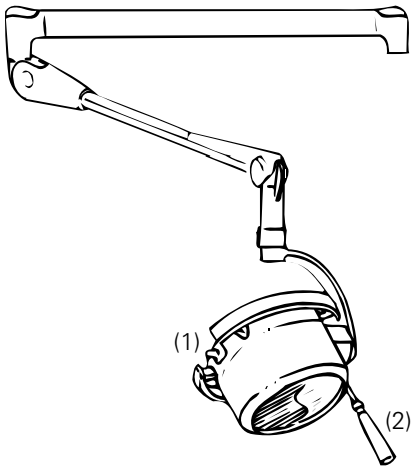
The radiation protection device can be moved along the ceiling rail:

- Pull down and turn the brake handle.
  – You can move the carriage freely in the ceiling rail.
- Move it to the required position.
- Release the brake handle.
- Position the radiation protection window so that it protects the examiner's eyes and thyroid.

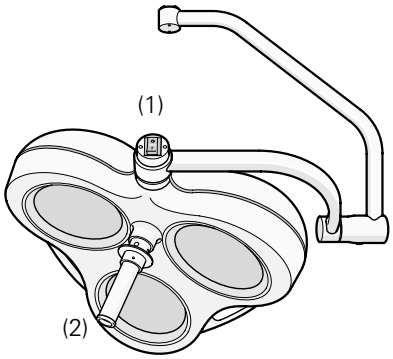
For patient positioning and when not in use, the upper body radiation protection should be positioned outside the swivel range of the system.

Examiner lights

1 light OR lamp



3 light OR lamp



(1) On/off switch

(2) Turn to adjust beam focus

Use The examiner light is used to illuminate the puncture point. It is attached to the carriage with a support arm, which can be moved freely in the ceiling rail.

The examiner light may also be mounted on the adapter of the radiation protection for the upper body with a separate support arm.

The light can be dimmed, and the light beam can be focused.

Depending on the system configuration, the light is either turned off by "X-radiation on" or it can be turned on or off using the footswitch.

During unit movements, especially swiveling movements, there is a risk of collisions and damage.

- Watch out for possible collisions while performing unit movements.

Releasing the brakes / locking the brakes

⇨ "Radiation protection for the upper body" on page 49.

Positioning

- When the brakes are released, you can move the carriage freely along the ceiling rail.

Switching on/off

The examiner light is *not* automatically switched on when the system is switched on. Generally the light is switched on/off directly at the lamp:

Depending on the configuration or installation, the light can be turned on or off during the examination with the footswitch or by radiation on/off.

◆ Press the on/off switch (1)

Dimming the 1 light OR lamp

◆ Turn the black knob (1).

Focusing the light beam

◆ Turn the handle (2).

The handle is also available in a sterilizable version.

Injector

Installation

The injector is mounted in different ways depending on the system combination.

❏ Can be moved on floor stand, with connection at examination table

❏ On the wall with a special wall bracket

❏ Injector head ceiling-mounted and mobile on the rails of the radiation protection or permanently attached to a column on an articulated arm similar to the radiation protection holder. The control console is installed in the control room or the examination room.

❏ Injector head with holder on the accessory rails of the patient table

Although a system might offer several different possibilities for connecting injectors, only one injector may be connected!
Only use injectors approved by Siemens.

⇨ See also the user manual for the **contrast medium injector** for details on installation and injector accessories.

Sterile covers

Disposable ready-sterile covers and protective hoods can be supplied to cover system components.

Please note the expiration date on the package.

Disposable protective hoods

Suitable for:

❏ Radiation protection window with a round cut-out

Disposable covers size 1

Round shape, 50 cm diameter

Suitable for:

❏ System control consoles

Disposable covers size 2

Rectangular shape, 75 cm x 80 cm

Suitable for:

❏ System control consoles

❏ Imaging system control console

❏ Flat detector (CARD)

❏ Injector head

❏ Injector control console

❏ Upper body radiation protection

❏ Single plane footswitch

Disposable covers size 3

Rectangular shape, 90 cm x 90 cm

Suitable for:

❏ Flat detector (Angio)

❏ Examiner light

Disposable covers size 4

Round shape, 115 cm diameter

Suitable for:

❏ all radiation protection shields without cut-out

❏ Megalix tube and collimator

❏ System control consoles

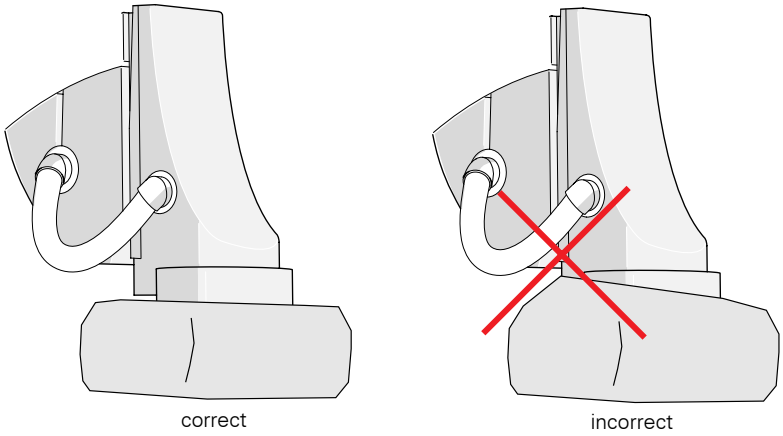
❏ Imaging system control console

Information about using sterile covers on the FD

Commercially available sterile and sterilizable covers can be used for the flat detector, X-ray tube assembly with primary collimator and scattered radiation protection.

- Please make sure that the sterile cover is only fitted directly around the FD (see figure).

The cover must not be fitted around the slide or the collision protection of the / FD because this can cause system operating problems.



Example for fitting of the sterile cover

Operator Manual
Troubleshooting

Chapter: System Messages / Troubleshooting

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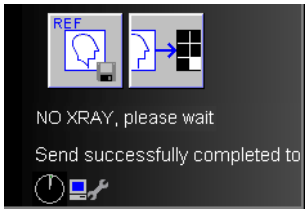
System messages

Locations System messages are displayed:

- ❏ on the data display (2 lines at bottom)
  - – Stand/table messages
  - – System status messages

- ⇨ Also see Part **System Overview / Operating Elements**, Chapter **Operating Elements and Displays in the Examination Room**, "Messages"

- ❏ on the monitor of the system console
  - – line at bottom of image (1 line of text)
  - – status area in lower part of control area (2 lines of text and 1 line of icons)



- ⇨ "Message lines" on page 4
- ◆ Please pay attention to these messages.
- ⇨ Also see Part **Examination**, Chapter **Preparing the Examination - Fluoroscopy - Acquisition**, "Monitoring the status displays"

Types There are various types of system messages:

- ❏ *Feedback*, e.g. "DYNA test phase, manual"
- ❏ *Instructions,* e.g. "DYNA: Perform fluoroscopy in the end position first"
- ❏ *Error messages*

Error handling

This system was developed in such a way that the *highest possible system availability* is guaranteed. In other words, the examination is obstructed as little as possible if, for instance, an error occurs due to a fault. A system status message is output that indicates the restriction; other system functions are, for the most part, not affected.

- ❏ The *examination-specific messages* indicate "rejection" if an operator attempts an action that the system is currently unable to execute.
  Example: "NO XRAY, please wait"
- ❏ The *status messages* indicate currently existing "operating restrictions" for as long as the restriction exists.
  Example: "MEMORY FOR < 4 ACQ RUNS"
  Operating restrictions that only the Service Center can remedy are marked with "... SC ...".
  Example: "NO XRAY: call SC"

⇨ “General problems - Troubleshooting ...”“... with fault messages marked "... SC"” on page 22

Message lines

Line in lower part of image

This line consists of two lines occupying the same space:

- ❏ In the foreground: *Examination-specific messages*
- ❏ In the background: *Messages for user guidance*

The line with the user guidance messages is only visible if no message is being displayed in the line for examination-specific messages.

User guidance messages contain *instructions* from the Artis Imaging System, e.g. if you are working on the **PostProc** or **Quant** task cards. You can also release many of these functions on the touchscreen control in the examination room. For that reason, this line is also visible in the examination room.

The examination-specific messages provide comments about rejection or cancellation of radiation or changes in examination programs or parameters (e.g. the selection of Peri or DYNA).

Messages of this type are cleared again after a short time; any user guidance messages will then reappear.

Examination-specific messages are cleared as soon as an attempt is made to release radiation or change parameters/programs.

Line 1 on the data display

The upper line on the data display also consists of two lines occupying the same space which display messages about the stand and table:

- ❏ In the background, positive feedback messages/states are displayed, such as "Position reached", "Manual image rotation: active", "DYNA: washout phase", ...
- ❏ In the foreground, unit operations are rejected, e.g. "Movement: End reached", "Wrong direction"

A rejection message is cleared when you release the incorrectly tilted joystick; the message in the background reappears.

Line 1 in the status area

The top line in the status area on the monitor of the system console is the line for *status messages*.

= line 2 on the data display

As long as the data display is connected to the Artis Imaging System, the same message will be displayed in the lower line on the data display. If not, the data display shows asterisks "***" (e.g. during start-up).

Here, restrictions about the availability of system functions are displayed: "Memory full", "BYPASS FLUORO", "Full access", ...

This restriction is displayed for as long as it applies. If more than one restriction is pending at one time, only the most important one is displayed.

Example 1 During bypass fluoroscopy it is irrelevant whether the memory is full or not.

⇨ "Bypass fluoroscopy (emergency operation)" on page 14

Example 2 If the reason for the bypass fluoroscopy is the setting "full access", this is displayed so that the reason for bypass fluoroscopy can be seen.

⇨ Part **Service Functions (Volume 1)**

If two or more restrictions are of equal importance, they are displayed alternately.

Line 2 in the status area

The center line in the status area on the monitor of the system console displays status messages of the imaging system, e.g. messages about print or send jobs.

There is usually not enough space to display the whole message text.

- Move the mouse pointer onto the message line to have the text displayed in its full length.

Line 3 in the status area

If functions are executed in the background, you will see the relevant application as an icon in the third line.

Function	Active function	Faulty function
Remote service	Remote service is enabled	Remote service is deactivated
	Remote service is active	
Sending	Data is being sent	It is not possible to send data
Import	Data is being imported	It is not possible to import data
Export	Data is being exported	It is not possible to export data
Film/Print	Images are being filmed/ printed	It is not possible to film/ print images

Status line in windows

Messages and information are also displayed in the bottom line of some windows, e.g. the **Patient Browser**.

Resource display

Your system monitors the memory usage and the storage capacity of the main database, the scheduler database and the exchange board (virtual memory).

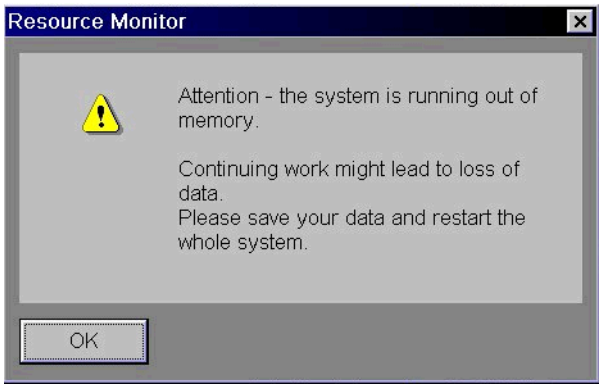
By the storage capacity icon you can see how much space has already been taken up in the local database. If the filled capacity rises above a configurable limit (default 95%), the icon changes color from green to red.

If you move the mouse pointer to this icon, the percentage of storage capacity already taken up is displayed.

Virtual memory

By the blinking storage capacity icon in the status bar you can see that the virtual memory is filled.

– The message **Resource Monitor** is displayed.


Resource Monitor
Attention - the system is running out of memory.
Continuing work might lead to loss of data.
Please save your data and restart the whole system.
OK

Caution

Insufficient system resources may lead to an instable or blocked system.

Risk that the system is not available in emergency cases.

- Do *not* ignore the resource warning icon.

- Follow the instructions. Restart the system, if necessary.
- If the error remains, call Siemens Service.

Action history

Actions executed by the program are logged together with information about whether the individual steps were completed successfully or whether an error occurred. You can query a list of the last entries in the history at any time.

Displaying messages

- Click into the message line (with the left mouse button).
  – Clicking on a text (lines 1 and 2) displays the full message text.
  – Clicking on an icon (line 3) displays the associated status window.

Defining the number of messages

- *Right*-click on the *second* line of the status area.
  – The **History** dialog box opens.
- Set the number of messages and confirm with **OK**.

Messages, causes, measures

This section lists and explains some typical types of messages.

Messages for unit movements

Message
- ❏ "... completed"
- ❏ "Position reached"

Cause: A movement to a programmed position or a procedure has been completed.

Measure:
- Continue with the next step (of the examination).

Message
- ❏ "Automatic run: Move ..."

Cause: During movement to a programmed position a manual movement is required to continue the examination.

Measure:
- Perform the necessary manual steps.

Message ❑ "... GUARD ACTIVE"

Cause A collision protection sensor has responded due to contact with an object or person.

Measure ◆ Remove the obstacle or execute a movement away from the obstacle.

Message ❑ "Collision with ..."

Cause The collision computer has noticed an object approaching the monitored area.

Measure ◆ Remove the obstacle or execute a movement away from the obstacle.

If you continue to operate the respective operating element, the unit automatically moves in the opposite direction until the collision is averted.

◆ Release the operating element briefly.
– After that, you can continue to work normally.

Message ❑ "Movement: End reached"

Cause The unit has reached the limit beyond which it can no longer continue the movement.

Measure ◆ Execute a movement in the opposite direction, if necessary.

Message ❑ "Wrong direction"

❑ "... not possible in this direction"

Cause The unit has reached the limit beyond which it can no longer continue the movement, or another direction is required for the examination.

Measure ◆ Tilt the operating element in the opposite direction.

Message ❑ "... release ..."

Cause A movement or radiation release is no longer required.

Measure ◆ Release the operating element.

Message ❑ "Movement without DMG, call SC"

Cause The unit was informed that a movement has been made without pressing a dead man's switch and therefore automatically released an emergency STOP because of the danger of collision.

⇨ Part **System Operation**, Chapter **Unit Movements**, "Safety equipment"

Measure ◆ Press an emergency STOP button and disengage it again.

⇨ Part **Safety** (**Volume 1**)
– Once the unit movements are functioning normally again and the message has disappeared, you can continue to work.

If the message comes up frequently:

◆ Contact Siemens Service.

No unit movement possible

Pay attention to the direction in which you have to tilt the operating element.

Message? ◆ Please pay attention to the information on the data display.

⇨ "Messages for unit movements" on page 8

Emergency STOP? ◆ Check the emergency STOP buttons.

⇨ Part **On/Off, Safety Check (Volume 1)**

Collision protection sensor? ◆ Make sure that no collision protection sensor has responded.

⇨ Part **On/Off, Safety Check (Volume 1)**

Patient? ◆ Do not forget to rescue the patient if it is not possible to remedy the error.

⇨ Part **Safety (Volume 1)**

Resetting the unit computer

If all these measures do not help, then there could be an error in the unit computer (SCU). In order to restore a defined status, you can reset the computer:

- Simultaneously press the buttons **I** and **II** as well as the **emergency STOP button** on the stand/C-arm control module (SCM).
  – The unit computer is restarted and should be ready for operation after a short time.
- Do not forget to pull the **emergency STOP button** again .

Restart necessary!

Some faults make it necessary to restart the imaging system or the entire system. For most faults, it is enough to restart only the imaging system.

Message

- ❑ "... Restart"
- ❑ "... Restart the imaging system"

Cause

The system is in a state that makes a restart necessary.

Measure

- Close the imaging system application and restart.
- ⇨ “Restarting after a fault” on page 18
- ⇨ Please pay attention to “Bypass fluoroscopy (emergency operation)” on page 14
- Register the patient again.
- Continue with the examination.

Shutdown necessary!

If it was not possible to restart (e.g. if there are faults in system communication), you must restart the entire system.

Message ❑ "... Please Power OFF"

Cause Communication between the imaging system and the other units is faulty. The entire system must be restarted.

Effect Now only postprocessing is possible. Normal fluoroscopy, acquisitions, and patient registration are not possible.

Measure
- ◆ Switch off the system.
- ⇨ Part **On/Off, Safety Check (Volume 1)**

RESET If this is not successful, you can reset the system.

⇨ "RESET" on page 19

Switching off manually If this is not successful either, you can switch off the system manually.

⇨ "Switching off manually" on page 21

Emergency SHUTDOWN If this is not successful either and there is a danger, the emergency SHUTDOWN button is the last resort.

⇨ Part **On/Off, Safety Check (Volume 1)**

Switching on again
- ◆ Switch the system on again, if required.
- ⇨ Part **On/Off, Safety Check (Volume 1)**
- ⇨ Please pay attention to "Bypass fluoroscopy (emergency operation)" on page 14
- ◆ Register the patient again.
- ◆ Continue with the examination.

Memory full!

Depending on the configuration, the Artis Imaging System can save a specific number of patients and a specific number of scenes/images in total and per patient.

If patients are not deleted regularly, this could result in shortage of storage capacity, and the Artis Imaging System will display a message indicating this state.

Message

❏ "MEMORY FOR < 4 ACQ RUNS"

❏ "Memory full, please delete scenes"

Cause

Free space in the memory is not sufficient (hard disk full). In this case, normal fluoroscopy is still possible, but acquisition (and **Store Monitor**/**Store reference image**) are rejected after the second message is displayed.

Measure

◆ Delete (archived!) scenes (if possible, scenes with several images).

⇨ Part **Image Viewing and Image Processing**, Chapter **Closing Postprocessing**, "Deleting patients/studies/series/scenes"

Message

❏ "Please delete a few patients soon"

❏ "Memory full, delete patients"

Cause 1

The number of free management units for images is insufficient (too many scenes/images). In this case too, normal fluoroscopy is possible, but acquisition (and **Store Monitor**/**Store reference image**) are rejected after the second message is displayed.

Cause 2

The disk for the images is fragmented. In this case, high speed acquisitions are not possible.

Measure

◆ Delete (archived!) patients (if possible, patients with many scenes).

⇨ Part **Image Viewing and Image Processing**, Chapter **Closing Postprocessing**, "Deleting patients/studies/series/scenes"

If the message reappears (especially when selecting high speed acquisitions):

◆ Contact Siemens Service.

Bypass fluoroscopy (emergency operation)

In various system states, e.g. during switch-on or switch-off or if a technical fault occurs or when no user is logged-in, only "bypass", that is, analog continuous fluoroscopy without the imaging system without LIH (only in plane A on Artis dBC/dBA), is possible. It is not possible to release acquisitions.

You can recognize this as follows:

- ❏ The fluoroscopy image is only visible in the examination room.
- ❏ The last fluoroscopy image (LIH, Last Image Hold) does *not* remain on the monitor.
- ❏ At the following locations, "BYPASS FLUORO" is displayed:
  – on the data display in the examination room,
  – in the status area on the monitor in the control room

In FD systems, only the nominal zoom format (zoom 0) is available during bypass fluoroscopy.

Depending on the problem, fluoroscopy times during "BYPASS FLUORO" might not be recorded in the **Exam Protocol**.

Bypass fluoroscopy during start-up

The "BYPASS FLUORO" display is normal during start-up.

After the imaging system is ready again, plane A is automatically active as the acquisition plane (on Artis dBC/dBA).

Please note that the monitors are not ready for operation immediately after switch-on.
The time before they are ready for operation depends on how long the system has been switched off and can be up to 60 s.

Bypass fluoroscopy during an examination

If the "BYPASS FLUORO" display appears during a normal work sequence, please do not ignore this message!

- ◆ You might have to reset the imaging system with a restart.

⇨ "Restart necessary!" on page 11 and "Shutdown necessary!" on page 12

Please note on FD systems with detector rotation:
In "BYPASS FLUORO" mode each component is set to default regarding image orientation. It may happen that the image is rotated in case of the detector position is not landscape.
This can be corrected by manual detector rotation override.

Power failure!

Hospital emergency power supply

A (hospital) emergency power supply cuts in if the mains power supply fails. However, this usually occurs with interruption and can take some time.

Depending on whether and which UPS is installed, the system might have to be switched on again.

System emergency power supplies

The system can have one of three types of emergency power supplies:

- ❏ Imaging system UPS
  Uninterruped supply for the imaging system only
- ❏ OR-UPS
  Uninterruped supply for system control including imaging system and stands
- ❏ System emergency power supply
  Interruped supply for the generator, uninterrupted supply for system control including imaging system and stands

UPS UPS = Uninterruptible Power Supply

A UPS is a battery-backed system which provides emergency power in the event of a mains power supply failure.

UPS for the imaging system

To prevent data/image loss, your system may have a UPS which shuts down the *imaging system* in a controlled way in the event of a power failure.

UPS operation

In the event of power failure, all indicators and displays are dark. Only the imaging system is still being powered by the UPS although the monitors are dark.

- ◆ Stop the examination.
- ◆ Do *not* press any keys.

After a configurable time (typically 2 minutes), the imaging system will shut down to prevent the backup battery to be exhausted.

Power recovers during this time

◆ Power on the system using the on-site room ON (or emergency SHUTDOWN) button, if necessary[1].

The system will be switched on again by the (still running) imaging system and it will be operable again after a short time.

Power does not recover

The imaging system will shut down when the recovery time has been elapsed. The shutdown needs a few minutes.

◆ Let the imaging system shut down.

After recovery of the power supply

◆ Power on the system using the on-site room ON (or emergency SHUTDOWN) button, if necessary[1].

◆ Switch the system on.

⇨ Part **On/Off, Safety Check (Volume 1)**

◆ Pay attention to any error messages.

◆ Check if all data/images are present.

OR-UPS

The OR-UPS supplies the patient table, stands and the imaging system during power failure. Its main use is for systems in the OR (operaing room).

All control modules remain functional during power failure.

Radiation is interruped during power failure and will be possible again, when mains power returns.

Emergency power supply[2]

If an emergency power supply is installed on your system for the unit and generator, it automatically switches to emergency operation if the mains power supply fails or if it drops too low.

[1] mandatory in Germany
[2] only in countries with a 50 Hz line frequency

During emergency power operation, you can only perform unit movements and bypass fluoroscopy (only in plane A for Artis dBC/dBA) without LIH. It is not possible to release acquisitions.

Continuous fluoroscopy during emergency power supply operation

If your system is equipped with a UPS, the imaging system is still powered but after switchover from mains to UPS operation, the generator is restarted (necessary waiting time about 20 to 30 seconds). During this restart, *radiation is not* possible.

The power that the emergency power supply can provide is limited. However, pulsed radiation requires a high power. For that reason, acquisitions cannot be released during emergency power operation. As an exception, fluoroscopy is only performed with continuous radiation.

A waiting time is also necessary for restarting the generator when the switchover from emergency power to mains operation occurs.

Switching back to mains voltage

- After recovery of the mains voltage, you must switch the system on *manually* on the UPS.

⇨ Please observe the operating instructions of the **UPS**.

- Register the patient again.
- Continue with the examination.

Switching on after a power failure or emergency SHUTDOWN

- Switch the system on again.
- Pay attention to error messages.

In the event of a power failure, the cooling system of the X-ray tube also fails.

- Pay attention to the thermal load on the X-ray tube after switching on the system again.

Restarting after a fault

Automatic error correction

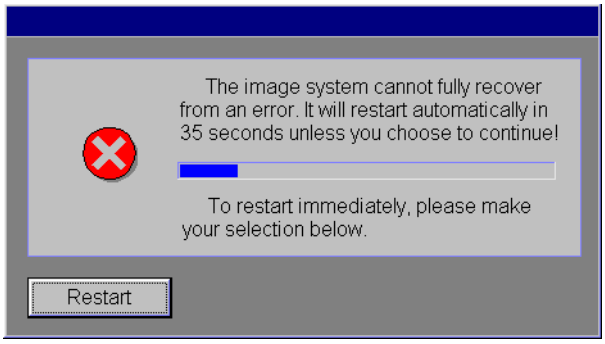
If an image processing error occurs during operation, the image processing program may be restarted.

The message "No image processing, please wait" shows that image and patient data cannot be accessed and that image processing is not possible.

- Wait for the message to disappear and icons on the monitor and selection fields on the touchscreen to become selectable (not dimmed).

Automatic restart on errors

If a fatal software error occurs, the Artis Imaging System has to be restarted. The following window appears on the monitor of plane A in the control room:


The image system cannot fully recover from an error. It will restart automatically in 35 seconds unless you choose to continue!
To restart immediately, please make your selection below.
Restart

After a certain time (configurable by Siemens Service), the Artis Imaging System is restarted.

Restart immediately

Caution

As long as this window is shown on the monitor in the control room, it is possible to continue with fluoroscopy or an acquisition series in the exam room!

After the configured time has elapsed or after you have clicked Restart, the imaging system is restarted; fluoroscopy and acquisition are then interrupted! Restarting takes some time.

- It may be necessary to wait during fluoroscopy/acquisition before clicking **Restart**.

If no fluoroscopy or acquisitions are being performed in the examination room, you can speed up restarting.

- Click **Restart**.
  – The Artis Imaging System is restarted.
  – Bypass fluoroscopy is still possible.

⇨ "Bypass fluoroscopy (emergency operation)" on page 14

Manual restart

If the message "... Restart Imaging System" appears, you must terminate the imaging system application and then restart it.

- Select **Options > End Session...** from the main menu.
  – The **End Session** dialog box is displayed.
- Click on **Restart Application...**
  – Another dialog box appears.
- Click on **Yes**.
  – The application is terminated and restarted.

Or

- Click on **Restart System...**
  – Another dialog box appears.
- Click on **Yes**.
  – The system is shut down and restarted.

Restart needs some time.

RESET

If this is *unsuccessful*:

Only if the imaging system does not respond to input even after some time, or if, for example, the screen is blue and only shows "cryptic" characters, may you restart the imaging system with the RESET button.

⇨ Part **System Overview / Operating Elements**, Chapter **Equipment in the Control Room**, "Power-on switch and indicators"

Caution

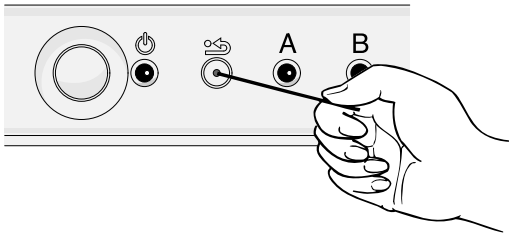
Resetting the imaging system

Risk of data loss

Only ever press the RESET button when the system is not ready.

- Wait until all drive activity has come to an end (*neither* of the two LEDs **A**, **B** next to the RESET button is lit).

In that case:



- Press the RESET button for longer than about half a second.
  – The imaging system is restarted and should be ready again after a few minutes.

Use a pointed object to press the RESET button, e.g. a ballpoint pen.

- Pay attention to error messages.

General problems - Troubleshooting ...

... if the system does not shut down

- If the system gets stuck during the automatic shutdown procedure, confirm any error messages.
- Then restart the system by double-clicking on the **Start AXIOM** icon and carry out the shutdown procedure again.

Reason — Preventive measure against loss of data.

Consequence if this is ignored
- ❏ Risk of data loss
- ❏ If the imaging system is operated by a UPS, the battery of the UPS will be completely discharged. It is possible that the system cannot be started again.
- ◆ In that case, contact Siemens Service.

Switching off manually

You may switch the system off manually with the power-on switch *only,* for example, if the imaging system is disabled and the system can no longer be terminated with the software.

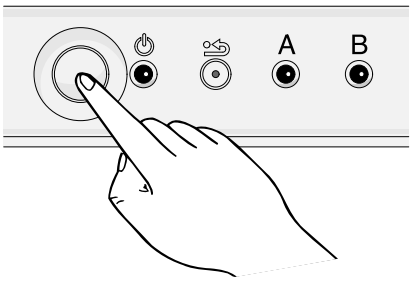
⇨ Part **System Overview / Operating Elements**, Chapter **Equipment in the Control Room**, "Power-on switch and indicators"

Caution

Switching off manually

Risk of data loss

- ◆ Wait until all drive activity has come to an end (*neither* of the two LEDs **A**, **B** is lit).



- ◆ Press the power-on switch for longer than about half a second.
- ◆ Release the power-on switch.
  – As soon as you release the switch, the system switches off.

... with fault messages marked "... SC"

Message ❑ "... SC"

Cause A serious fault has occurred.

Measure
- ◆ Note down
  - – the text of the message
  - – the time of the fault (date/time)
  - – the function that was executed when the fault occurred

This information is useful for our service personnel.

- ◆ If necessary, perform a restart.

⇨ Part **On/Off, Safety Check (Volume 1)**

If the message is displayed again:

- ◆ Contact Siemens Service.

... in the event of the message "overtemperature"

Message ❑ "... Overtemperature"

Cause The temperature in a component of the system is too high.

Measure
- ◆ Check whether the overtemperature has been caused, e.g. by impermissible covering (drapes). Are the ventilation slots unobstructed?
- ◆ Check the ambient conditions.

If you cannot rectify the cause immediately:

- ◆ Shut down the system as quickly as possible (not for the X-ray tube assembly).
- ◆ Allow the system to cool down.
- ◆ Switch the system on again after it has cooled down.

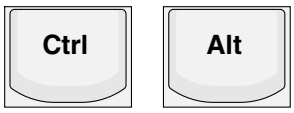
If overtemperature occurs again without any identifiable reason:

- ◆ Contact Siemens Service.

... if a window appears on a different monitor

Normally you can move the mouse pointer only on the image monitor(s) in the control room.

If, for example, due to a malfunction a window appears on another monitor (e.g. the reference image monitor), you can nevertheless reach it as follows:



- Press and hold the **Ctrl** and **Alt** keys.
  – Now the mouse pointer is no longer restricted to the monitor image(s) in the control room.
- Move the mouse pointer beyond the right edge of the screen.

... if the image quality changes

If you notice any changes in the image quality (fluoroscopy/acquisition) which cannot be explained by special examination conditions (e.g. weight of the patient, patient to FD distance too large, extreme angulations, use of extreme enlargement or acquisition programs), then proceed as follows:

- Perform a consistency test (as stipulated by national regulations).
- Ask Siemens Service to perform a quality assurance test.

Image quality control (IQAP, Image Quality Assurance Program) is part of a service contract.

- If necessary, provide images for remote service.

⇨ Part **Service Functions (Volume 1)**

... if no radiation is released

Radiation indicator lights up

The radiation indicator lights up but no image is generated.

- Pay attention to the messages on the data display.
- Restart the system.

⇨ Part **On/Off, Safety Check (Volume 1)**

If a fluoroscopy image is still not displayed:

- Switch off the system and contact Siemens Service.

It is normal for the radiation indicator to light up briefly while the system is starting up.

Radiation indicator is not lit

Message? If a message "No XRAY ..." is displayed, radiation is blocked.

- Read the message and perform correspondingly.

Door contact? Depending on your installation, it might be necessary for the doors of the examination room to be closed.

- Check the radiation disable switches (e.g. door contact) if there are any.

Plane ready? Are the green "plane ready" displays on the stands lit?

⇨ Part **System Overview / Operating Elements**, Chapter **Operating Elements and Displays in the Examination Room**, ""Plane ready for radiation" displays"

- Restart the system.

⇨ Part **On/Off, Safety Check (Volume 1)**

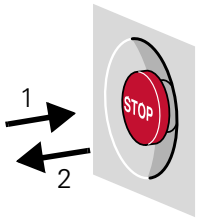
Other reason?

In rare cases, radiation may not be released due to a system communication problem. In this situation, the system seems to be ready.

❏ The system message line (line 1 in the status area = line 2 on the data display) does not show any restriction.

But

❏ No footswitch pedal or handswitch action releases radiation.



◆ Press the **emergency STOP button** on the stand/C-arm control module (SCM) and pull it again.
– The system communication is re-initialized.

Now radiation should be possible again, at least in "BYPASS FLUORO" mode.

◆ Press a radiation release pedal/button again.

If still no radiation is released and no image is displayed:

◆ Switch off the system and contact Siemens Service.

... if there is a problem with the FD cooling system

When the FD cooling system has failed, the flat detector can operate for a definite time until the detector gets too hot.

In this case, the message "No XRAY available in ... min." is shown and a countdown runs.

◆ Check the FD cooling system.

Caution

Malfunction in the detector cooling system and display of the message "No X-Ray available in ... min." (with FD systems only)

Risk that the examination cannot be completed

When the countdown has elapsed, radiation will no more be possible.

◆ Complete the current examination within the remaining displayed time.

... if the radiation is aborted

Message On the monitor at the bottom of the image, the following message is displayed: "XRAY aborted: Dose less than 5%"

Cause If during acquisition (or fluoroscopy) the dose falls below 5% of the nominal value (e.g. because of a thick object), radiation is blocked due to radiation protection reasons. In this case, the images would not have anymore diagnostic value.

Measure If radiation is aborted during acquisition (or fluoroscopy) perform as follows:

- Check the kV display.

If 125 kV is indicated on the kV display, the dose is probably no more sufficient to produce a usable diagnostic image.

To continue working, the radiation must be increased.

You can achieve this by the following measures, for example:

- Change the projection (angulation).

And/or

- Move the FD closer to the patient.

And/or

- Decrease the FD zoom factor.

If the radiation is aborted again (even with a thinner object), it is possible that there is a technical defect.

- Pay attention to further messages.

If there is a technical defect:

- Contact Siemens Service.

... if the image appears smaller than normal on the monitor

If the change in image size is not due to geometric magnification (object-FD distance):

- Terminate the examination as quickly as possible.
- Contact Siemens Service.

Incorrect measurements (calibration errors) cannot be excluded when evaluating such images.

... if the monitor image is blurred

To avoid faulty diagnosis due to lack of detail:

- Terminate the examination as quickly as possible.
- Contact Siemens Service.

... if the live image is not collimated correctly

On a correctly collimated image a slightly blurred edge of the universal collimator leaf must be visible within the edges of the electronic shutter.

If this is not the case, the system is not adjusted properly and there is a risk of parts being exposed to radiation although they are not displayed in the image.

- Contact Siemens Service.

... if the format collimation is incorrect

The automatic format collimation (collimation to the input format) is normally set so that you can see at least one of the collimator leaves in the fluoroscopy image during BYPASS FLUORO (national regulations).

Enlarged collimation can cause increased scattered radiation.

If you notice a fault during collimation to the selected format when viewing the screen or because of an error message on the display, proceed as follows:

◆ Press the red emergency STOP button and release it after 5 s

Or

◆ Restart the system.

⇨ Part **On/Off, Safety Check (Volume 1)**

If there is still no collimation to the selected input format:

◆ Contact Siemens Service.

... if there is a fault in the primary collimator

Message ❑ "Fault in ... collimator"

Cause A fault has occurred in the primary collimator or the collimator is not ready for operation.

Measure Not normally necessary; faults in the primary collimator are usually cleared up automatically.

❑ If the collimator fault is not cleared up automatically, proceed as follows:

◆ Press the red emergency STOP button.

◆ After about 5 s release the emergency STOP button again.
– This results in a unit reset.

❑ If the error is still displayed,

◆ switch the system off and on again.

⇨ "Restarting after a fault" on page 18

❑ If the primary collimator is still not ready for operation,

◆ Contact Siemens Service.

... if the collimator rotation is not correct

- Press the **Home** button.
  – Collimator leaves and filter diaphragms are moved into their initial position outside the image.

... if the X-ray tube assembly emits a warning signal

The permissible range of the cooling temperature can be exceeded if the load for the tube assembly is excessively high or the cooling circuit is defective.

If this happens, a warning signal is emitted by the tube in addition to the HU display.

⇨ Also see "... at tube overload (MEGALIX)" on page 30

High load

If the warning sound was not caused by a defect in the cooling system but by a continuous high tube load, you can continue fluoroscopy; use a dose saving fluoro mode, if possible.

- In this case do not switch off the system since this would switch the cooling system off at the same time.
- However, you should not release another acquisition scene before the oil-water circuit has cooled down, i.e. the continuous warning signal is off and the HU display shows < 60%.

Cooling circuit

If the cooling circuit is defective, the tube assembly can emit the warning signal even if the HU display shows a low value.

- If this warning signal is emitted, you should place the catheter in a position from which it can later be withdrawn without fluoroscopy, if necessary.
- Check the cooling system.

If you cannot rectify the fault immediately:

- Terminate the current examination and contact Siemens Service.

... at tube overload (MEGALIX)

MEGALIX X-ray tubes with closed circuit cooling feature protection from thermal overload by warning and safety circuits.

❏ On tube overtemperature: Intermittent sound at tube

❏ On cooling unit fault: Continuous sound at tube

Preliminary warning level

This *cooling unit fault* is a fault in the outer cooling water circuit.

◆ In that case, terminate the examination as quickly as possible.

Otherwise the safety circuit of the generator will automatically block high voltage.

◆ Contact Siemens Service.

Tube overtemperature is caused by *excessive operating power*. You can finish off any acquisition or fluoroscopy series in progress because the water cooling in the cooling unit is working.

After a load break of about 5 minutes or if operation is resumed with reduced power, the unit will return to normal temperatures. The audible signal then stops.

◆ Ascertain which fault is the cause (cooling unit fault or excessive operating power) and proceed as described above.

Shutdown level

On persistent thermal overload of the tube, a safety circuit switches off the high voltage at the generator. Switching on again is possible only after a cooling pause of approximately 15 minutes.

... if the pressure switch in the tube assembly responds

If the oil temperature in the cooling circuit of the tube assembly continues to increase after passing the threshold for the continuous warning signal, generation of radiation is disabled for safety reasons when it approaches approximately 78°C and a message to this effect appears on the display.

Do not switch the system off since this would also switch off the cooling system.

- As soon as the radiation blockage is removed, that is, the message on the data display disappears, you can continue fluoroscopy. If possible, use a dose saving pulsed fluoroscopy mode with a low pulse frequency.
- Acquisition scenes should be released only after the oil-water circuit has cooled down, that is, the continuous warning sound has stopped.

- Please inform Siemens Service.

... if there are problems with the ECG

- Check correct placement of the electrodes with sufficient contact gel.
- Lay cables of the patient leads directly next to each other and parallel to the patient's body.
- Check the connection of all plug-in connections and ground conductors.